Progress on the Action Plan for Safe Drinking Water

in British Columbia

2008

From the Office of the
Provincial Health Officer

BRITISH COLUMBIA
Office of the
Provincial Health Officer

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And electronically (in a .pdf file) from:
http://www.health.gov.bc.ca/pho/

ISBN 978-0-7726-6141-8
Date: March 18, 2008
British Columbia. Office of the Provincial Health Officer
Progress on the action plan for safe drinking water in British Columbia 2008 from the Office of the Provincial Health Officer.

Library and Archives Canada Cataloguing in Publication

British Columbia. Office of the Provincial Health Officer
Progress on the action plan for safe drinking water in British Columbia / from the Office of the Provincial Health Officer.

ISBN 978-0-7726-6141-8

1. Water-supply–Government policy–British Columbia. 2. Drinking water–Standards–British Columbia. 3. Drinking water–Health aspects–British Columbia. 4. Water quality management–British Columbia. 5. Drinking water –Law and legislation–British Columbia. 6. British Columbia. Drinking Water Protection Act. 7. Municipal water supply–British Columbia. 8. Waterworks –Government policy–British Columbia. I. Title.

TD227 B7 B74 2008 363.6'109711 C2009-901756-3

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From the Office of the
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BRITISH COLUMBIA

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Provincial Health Officer

Ministry of Healthy Living and Sport
Victoria, BC

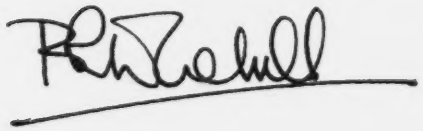
March 2009

The Honourable Mary Polak
Minister of Healthy Living and Sport

Madam:

I have the honour of submitting the Provincial Health Officer's report, *Progress on the Action Plan for Safe Drinking Water in British Columbia,* for the years 2005/2006 and 2006/2007.

Sincerely,



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Acknowledgements

The Provincial Health Officer is grateful for the contributions to this report by the following people:

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Mercury Art & Design

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Lucy Beck
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Highlights

This report charts progress made on each of the eight key principles in the provincial government's Action Plan for Safe Drinking Water in British Columbia.[1] It also reports on activities under the *Drinking Water Protection Act* in accordance with the reporting requirements of Section 4.1 of the Act.

The report covers programs and initiatives active during the 2005/2006 and 2006/2007 fiscal years. It follows a similar format to the 2007 report, which covered the 2003/2004 and 2004/2005 fiscal years. The 2007 report is found online at http://www.health.gov.bc.ca/pho/pdf/WaterReport.pdf.

Most British Columbians live in a small number of urban centres and receive high quality drinking water from a few large drinking water suppliers. However, there are more than 4,500 public drinking water systems in the province. The vast majority of these serve very small communities. Water suppliers serving the larger urban areas, as well as some of the smaller centres, are staffed by professional engineers and certified operators who are well qualified to provide the public with the highest quality water possible. When water quality concerns do arise, these suppliers have systems in place to notify their consumers and to correct any problems.

Some water suppliers serve high quality groundwater that requires no treatment to make it safe to drink. However, water from some wells or from any surface water source must be treated. Treatment may include filtration and then disinfection, or just disinfection using chlorine, chloramines, ultraviolet irradiation, or ozonation. Drinking water officers work with water suppliers to ensure drinking water is adequately treated or that plans are in place to improve water treatment, where necessary.

British Columbians who live in small communities or in remote areas, or who are served by water from their own wells, are generally the ones who face challenges with their water supplies. For these suppliers, challenges can include:

- Inadequate treatment.
- Trouble attracting and retaining trained and certified operators.
- Difficulty in accessing laboratory services in a timely manner for testing water samples for *Escherichia coli (E. coli)* and total coliform bacteria.
- Lack of funding support for making improvements to infrastructure.

As described throughout this report, progress is being made to address all of these challenges. In many cases, progress is slow.

[1] *The Action Plan for Safe Drinking Water in British Columbia can be found online at http://www.health.gov.bc.ca/cpa/publications/safe_drinking_printcopy.pdf*

In 2002, the government developed its Action Plan for Safe Drinking Water in British Columbia. The Action Plan follows eight principles:

1. The safety of drinking water is a public health issue.
2. Source water protection is a critical part of drinking water protection.
3. Providing safe drinking water requires an integrated approach across all the ministries and agencies that have legislated authority for water protection from source to tap.
4. All water systems need to be thoroughly assessed to determine risks.
5. Proper treatment and water distribution system integrity are important to protect public health.
6. Tap water must meet acceptable safety standards and be monitored.
7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Each of these eight principles is discussed in its own numbered section in the report. The following are highlights from each section.

Section 1. Public Health Protection

Access to clean, safe, and reliable sources of drinking water remains a basic tenet of public health protection. In British Columbia, the Ministry of Health[2] is the lead provincial ministry responsible for drinking water. It works closely with other government ministries, the health authorities, and water supply organizations to make sure public health is protected from threats to drinking water.

During the reporting period (fiscal years 2005/2006 and 2006/2007), regulatory amendments were made to better protect public health. Changes to the Drinking Water Protection Regulation clarified who is responsible for disinfecting drinking water supplies, required water samples to be tested for both *E. coli* and total coliforms, and enabled better reporting of water sample testing results. Changes to the Violation Ticket Administration and Fines Regulation improved enforcement of the *Drinking Water Protection Act* and regulation by making it possible for drinking water officers and others to issue tickets for violations.

All drinking water officer positions in the health authorities are now filled. To support drinking water officers in carrying out their duties, the Ministry of Health provided guidance on how to use the *Drinking Water Officers' Guide* (amended during the reporting period) as well as training during an annual conference. Drinking water officers also attended educational workshops. To fund this training and education, the provincial government provided $1 million per year to the five regional health authorities ($200,000 each).

Between April 1, 2005, and March 31, 2007, three new laboratories received approval from the Provincial Health Officer to test the bacteriological quality of drinking water samples. These new laboratories expanded coverage in remote and underserved areas of the province, giving water suppliers in the North and East Kootenays a better chance of getting their water samples to an approved laboratory within the required 30 hours of sample collection. As part of the effort to continuously improve laboratory services in the province, the Enhanced Water Quality Assurance Program conducted and reviewed 18 laboratory audits and improved auditing tools.

While no outbreaks of waterborne disease were reported, water suppliers did issue water quality advisories and boil water notices in approximately 10 per cent of communities around the province. The majority of these water systems were small and served a combined estimated 1 per cent of the province's population.

There was one large precautionary advisory in Metro Vancouver in November 2006, as a result of very high turbidity levels. The advisory affected most of the area's population; however, no increased illness was observed, and there was no evidence of increased pathogen numbers in the source water.

While water suppliers generally do a good job of notifying the public of water quality concerns, data collection and reporting at a regional and provincial level continues to be inadequate.

[2] *In 2008, the responsibility for the* Drinking Water Protection Act *was transferred to the Ministry of Healthy Living and Sport. Where the Ministry of Health is mentioned in this report, the Ministry of Healthy Living and Sport is now the responsible ministry.*

Data collection and reporting challenges may eventually be resolved through the drinking water information initiative and the BC-Yukon public health information project, but further commitment from the government is required.

Section 2. Source Water Protection

Source water protection is an important component of the multi-barrier approach to ensuring safe drinking water. While it is not the ultimate solution for all drinking water problems, source water protection helps maintain source water quality by making sure it is not significantly degraded through industrial, agricultural, or recreational activities, or through land development.

Protecting sources of drinking water is complex and relies on the work of many individuals and organizations, including federal government departments and provincial government ministries and agencies, local governments, political leaders, non-governmental organizations, special interest groups, and the general public.

During the reporting period, changes were made to legislation and regulations that have an impact on source waters. For instance, the Ground Water Protection Regulation came fully into force. The regulation focuses on water quality protection and the sustainable use of groundwater supplies. Part 2, which took effect on November 1, 2005, deals with standards for well construction and closure and the identification of wells. The Ministry of Environment has been implementing the regulation through compliance promotion, registering well drillers and pump installers, compliance audits, enhancing the WELLS database, processing submitted well reports, and by building internal capacity.

Overall, the number of Ministry of Environment staff working directly or indirectly on drinking water issues increased over the reporting period from the equivalent of 25 full-time positions to 28. This workload was undertaken by more people largely through activities related to general water quality protection activities. Various Ministry of Environment programs monitor and assess water quality, including a water quality monitoring network, which monitors raw water quality used as a source for drinking water and aquatic systems. During the reporting period, the Ministry of Environment continued to develop water quality guidelines for specific water quality variables in source water (based on the designated water use) and established water quality objectives to protect the most sensitive water use at a specific location.

Between 2005/2006 and 2006/2007, the Ministry of Environment increased spending on contracts and expenses for water quality initiatives by approximately 24 per cent. Its grants and funding transfers to non-governmental and other organizations to support source water protection efforts increased nearly 40 per cent, from $255,000 to $354,000.

To help water suppliers implement water conservation programs, the Ministry of Environment issued advisories when rivers experienced low streamflows. Further, ministry staff worked with smaller local governments to develop and refine drought management plans and water restriction bylaws. The government worked with the Township of Langley to make sure its Water Management Plan (the first of its kind in the province) ensures a safe and sustainable supply of groundwater to the community.

Also in the area of water conservation and sustainability, the British Columbia Water & Waste Association, in partnership with the provincial government, continued to develop the Water Sustainability Action Plan. The plan has evolved into a comprehensive program called "Convening for Action." It envisions that water sustainability will be achieved in BC through the implementation of green infrastructure policies, practices, and standards. Initiatives undertaken in the reporting period include the South Okanagan Regional Growth Strategy, the Water Balance Model for British Columbia (http://www.waterbalance.ca) and the Waterbucket.ca website (http://www.waterbucket.ca).

In the area of watershed protection, progress was made towards amending the *Forest and Range Practices Act* to allow the designation of community watersheds and to ensure this designation is done in a fair and consistent manner which takes public safety and sound resource management into account.

The Forest and Range Evaluation Program is working to determine whether licensees are meeting government objectives. In the area of water, these objectives deal with stream bank erosion, landslides, and livestock concerns. Staff are developing an evaluation procedure for water that is expected to be ready for province-wide application in 2009.

Other government ministries are also involved in protecting source water. During the reporting period, the Ministry of Agriculture and Lands conducted studies about soil nutrients and water, issued advisories and undertook projects related to manure loading, continued to support the Environmental Farm Plan Program and the National Water Supply Expansion Program, and initiated water metering projects.

Section 3. Integration

The delivery of safe drinking water is a complex process involving many partners. It requires the cooperation and dedication of water suppliers, local governments, health authorities, federal and provincial government agencies and ministries, First Nations, and the general public.

In 2005/2006 and 2006/2007, the provincial government moved forward on initiatives to improve communication and coordination on drinking water issues and projects across sectors. A number of committees oversaw this work, including the Assistant Deputy Ministers' Committee on Water, the Directors' Inter-Agency Committee on Drinking Water, the Drinking Water Leadership Council, the Multi-Jurisdictional Committee on Water and Wastewater Issues and First Nations, and two Federal-Provincial-Territorial coordinating committees (the Federal-Provincial-Territorial Committee on Drinking Water and the Federal-Provincial-Territorial Committee on Health and Environment).

Highlights of their accomplishments include:

- Development of a new Memorandum of Understanding (MOU) on Inter-Agency Accountability and Coordination on Drinking Water Protection, which describes the responsibilities and accountabilities of the Office of the Provincial Health Officer, the regional health authorities, and the various government ministries responsible for all aspects of drinking water protection.
- Development of a Water Action Plan for BC. The provincial government has made a high-level commitment to "Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none." To meet this goal with respect to water quality, the Ministry of Environment has taken a lead role in developing a cross-government strategy to address all water quality issues in a coordinated manner. An overarching water action plan is being developed.
- Completion of regulatory amendments (Drinking Water Protection Regulation and *Escheat Act*).
- Update of the 1988 Inter-Agency MOU on the Sale of Crown Lands.
- Completion and update of the Drinking Water Officers' Guide.
- Update of the 2000 Letter of Understanding Between the Interior Health Authority and Health Canada Regarding the Delivery of Environmental Health/Health Protection Services on Indian Reserves Within the Interior Health Authority.

In First Nations communities, Health Canada's community-based Drinking Water Safety Program monitors and ensures the safety of drinking water supplies. To develop First Nations capacity in this area, during the reporting period, Health Canada's Environmental Health Services' Program created reference documents and held workshops in Kamloops, Nanaimo, and Terrace. In addition to First Nations community members, the workshops included drinking water officers from the health authorities and representatives from Indian and Northern Affairs Canada and the BC Water & Waste Association.

During the reporting period, incremental progress was made towards a drinking water information management solution that would allow water suppliers, health authorities, government agencies, and land users to pool their data and benefit from access to more comprehensive information. Strong commitment from government is needed to see this major project to completion.

Section 4. Water System Assessments

Drinking water system assessments are critical to gaining an understanding of the state of BC's drinking water supplies and what needs to be done to improve them. For instance, systems that have been assessed high hazard ratings can be assigned higher priority for infrastructure or other improvements. The Ministry of Community Services*

** In 2008, the ministry was renamed the Ministry of Community Development*

provided nearly 180 grants to communities to help them plan for infrastructure upgrades.

In 2005/2006 and 2006/2007, inconsistencies remained in how hazard ratings for water systems were assigned by drinking water officers. While more than 2,000 water systems were inspected during the reporting period and more than 4,000 of the province's 4,591 water supply systems had current hazard ratings, data collection and reporting was inconsistent and incomplete. By the end of the reporting period, 535 systems had yet to be rated.

On the positive side, the assessment tool developed by an inter-ministerial team during the last reporting period (the Comprehensive Source-to-Tap Assessment Guideline) is being used by drinking water officers in the health authorities. The tool will be revised based on an evaluation carried out during the reporting period.

Section 5. Water Treatment and Distribution

Water treatment and distribution are at the heart of providing clean, safe, and reliable drinking water to consumers. Without proper treatment and distribution system operation, public health is at risk.

In BC, all public drinking water supplies collected from surface water sources such as lakes and rivers must be disinfected. Similarly, where a drinking water officer believes that a groundwater source is at risk of containing pathogens, the water supplier must provide disinfection. Close to 900 drinking water systems in the province disinfect their water and just over 400 of these also provide filtration.

Systems must be run by certified operators and other qualified professionals. While the number of certified operators in the province has risen from 1,400 to 1,600 in recent years, more work needs to be done. At least 1,200 systems need to improve the certification status of their operators. It is a similar situation with the number of water systems that have been classified based on their level of complexity; while close to 1,000 systems have been classified, nearly three times as many have not. Classification of systems and operator certification go hand-in-hand.

On a positive note, the vast majority of water systems (more than 3,000) in the province have been issued operating permits. More than 650 of these systems have conditions on their permits. Unfortunately, while the number of systems that have an emergency response or contingency plan in place has increased in recent years (from 425 in 2004 to nearly 1,500 in 2007), a significant number (mostly serving fewer than 300 connections) do not have an adequate, or in many cases any, emergency response plan in place.

As discussed in the previous report, the province's physical drinking water infrastructure is aging and much of it needs to be upgraded or replaced. Infrastructure funding programs are working to improve this situation. Indeed, from the start of the programs until the end of the 2006/2007 fiscal year, the combined Canada/British Columbia Infrastructure Program and the BC Community Water Improvement Program had improved drinking water quality for 20 per cent of British Columbians. This number is expected to jump to 72 per cent once the Seymour-Capilano water filtration plant (serving Metro Vancouver) is completed in 2009.

During the reporting period, 883 construction permits were issued for improvements and extensions to existing drinking water systems as well as for new systems. To streamline procedures for issuing construction permits and for maintaining and repairing infrastructure, amendments were made to the Drinking Water Protection Regulation in December 2005. For instance, qualification requirements for individuals running very small water systems with limited operational requirements have been reduced to make them more realistic. Amendments were also made to the *Escheat Act* to make it possible for the provincial government to turn escheated systems and their operation over to local governments.

Section 6. Drinking Water Quality

Drinking water quality is measured through programs that monitor treatment effectiveness and treated water quality. Treatment effectiveness monitoring varies with the type of treatment used. For a system that simply chlorinates, it involves measuring the amount of chlorine in the water and the length of time between chlorination and when the water

reaches the first consumer. This calculation allows operators to determine the percentage of pathogens that would have been killed by the chlorine.

Samples of drinking water are taken at the treatment plant and in the distribution system and then sent to laboratories for testing and analysis. In December 2005, the Drinking Water Protection Regulation was amended to require water suppliers to have their water tested for total coliform bacteria and *E. coli*. In 2006/2007, health authorities reported that 823 water systems met the sampling requirements set out in the regulation. The remaining systems did not meet the requirements for a number of reasons, such as not being able to transport the samples to an approved laboratory within the required 30 hours of collection or systems having old operating permits that do not list sampling frequencies. The BC Centre for Disease Control reported that in each of the 2005/2006 and 2006/2007 fiscal years, it tested approximately 65,000 water samples for *E. coli* bacteria. In 2006/2007, 657 samples were reported positive for *E. coli*. The number of samples tested by other approved laboratories is unknown.

In addition to the bacteriological sampling requirements, drinking water officers require water suppliers to test for chemicals and physical parameters on a system-by-system basis. In 2006/2007, health authorities reported that 115 systems were tested for parameters such as metals (e.g., arsenic, iron, manganese, etc.), nitrates, fluoride, and disinfection by-products such as trihalomethanes. Where levels of contaminants exceed the maximum acceptable concentrations set out in the *Guidelines for Canadian Drinking Water Quality*, drinking water officers discuss the results with the water supplier and may require the public to be notified of any potential health risks. Drinking water officers may also require steps to be taken to improve water quality through treatment or by obtaining a new water source.

Section 7. Small Systems

Ensuring people in small communities have access to high quality drinking water has long been a challenge in BC. Since December 2005, small systems have been defined by the Drinking Water Protection Regulation as those serving fewer than 500 people per day. Amendments to the regulation at that time gave small systems greater flexibility with respect to operator qualifications and in choosing point-of-use and point-of-entry treatment devices as a way of treating drinking water in very small communities.

Small water supply systems are often underfunded because of their small tax base and because costs of treating drinking water are not proportionate to population size. In some cases, the population served by the system are opposed to the rate increases that would fully fund necessary infrastructure upgrades or proper operation. Large urban communities can realize cost savings because they operate on a much larger scale and can generally access financial assistance from federal and provincial grant programs. Water supply systems not owned by local governments have to fund operations and improvements through their water rates unless they are able and willing to access resources through local governments. This option may require a transfer of ownership of the water system to the local government. Such transfers of ownership are often seen as undesirable to the community due to potential rate increases or loss of autonomy. Conversely, local governments, such as regional districts, may see them as undesirable because they will then own a water supply system that does not meet regulatory requirements, posing a liability to the government.

In order to better understand the relationship between small systems and regional districts and to explore options for improving the way small systems are managed, the Ministry of Health initiated a survey of regional districts, undertaken by the Ministry of Community Services. The survey found that the regional districts manage 115 "local service area" water systems, three-quarters of which serve 300 or fewer connections. One-third of the systems have public health concerns including unsustainable water sources, untreated water, aging infrastructure, inadequate cross-connection controls, and bacterial regrowth in the distribution system. In many cases, small systems benefit from conversion to regional district ownership. Benefits include access to government funding programs, qualified operators, technical assistance, more sophisticated management (including access to technology), and shared assets and other economies of scale. The survey revealed that regional districts are willing to consider more conversions as long as some key issues are addressed, such as liability, financial support, and clear commitments from the people served by the water supply system to see the process through.

Over the past few years, the provincial government, health authorities, water supply associations, and others have put considerable effort into understanding the challenges facing small systems and developing new support mechanisms. These include programs for small community water systems that deal with Supervisory Control and Data Acquisition (SCADA) solutions, group loans, and access to liability insurance; publications related to capacity building, sustainable operations, and pricing; studies and surveys of the management of small water systems and the use of point-of-use and point-of-entry water treatment devices; and courses and training opportunities for operators of small water systems.

Section 8. Full-Cost Accounting

Full-cost accounting is a process that ensures water suppliers are funding all water system costs through their basic water rates, neither subsidizing water supply system costs through other revenue streams (general tax base), nor deferring costs of future infrastructure or operational needs.

The Action Plan for Safe Drinking Water in BC states that "water should be affordable, with users paying appropriate costs." During the reporting period, some progress was made to improve the affordability of water by reducing costs to consumers and to ensure that consumers are paying for the actual costs of providing safe water, even if this means rate increases.

Water rates should be structured to cover day-to-day needs as well as long-term considerations. They should reflect population growth, the replacement of aging infrastructure, the training of operators, and contingency needs. At the same time, water rates should be affordable to the people paying them.

One of the greatest challenges is to determine what affordable means to different people, many of whom feel that water should be free. The actual cost to the water supplier of water licensing fees is relatively low for surface water. There is no fee for groundwater, which is unlicensed. The bulk of the cost of providing drinking water rests in the infrastructure needed to collect it, the treatment plants needed to make it safe, the distributions systems needed to transport it to users, and the associated operational costs.

The final cost of providing drinking water to the consumer varies greatly across the province: from pennies per cubic metre to more than a dollar per cubic metre. In some cases, sewage costs are built into water rates, raising the cost per cubic metre closer to $2.00. Even where rates are relatively high, the cost of a day's worth of water for drinking purposes (usually about 1.5 to 2 litres per day) is less than a penny per person. Most of the cost of the average water bill comes from covering other household water needs such as bathing, sanitation, and watering lawns and gardens.

The assessments conducted by health authorities and water suppliers discussed in Section 4 will help to improve planning for long-term needs, while access to affordable liability insurance through the Sustainable Infrastructure Society's group liability insurance program can greatly reduce insurance costs for small water suppliers. Amendments to the Drinking Water Protection Regulation that accommodate the use of point-of-use and point-of-entry treatment for small water supply systems may allow for more cost-effective treatment for small communities. Similarly, the greater flexibility in operator qualifications will alleviate training costs for some small water supply systems without compromising safe operations.

Recommendations

While significant progress has been made to address many of the gaps identified in the 2007 report *Progress on the Action Plan for Safe Drinking Water in British Columbia*,[3] much remains to be done. The recommendations section in this report looks at the previous recommendations and provides commentary on progress made to date. New and revised recommendations for 2008 are also given.

[3] *This report covered the period of May 2003 to March 31, 2005.*

Introduction

This report charts progress made on each of the eight key principles in the Action Plan for Safe Drinking Water in British Columbia, developed in 2002 by the provincial government. It also reports on activities under the *Drinking Water Protection Act* in accordance with the reporting requirements of Section 4.1 of the Act. This report covers programs and initiatives during the 2005/2006 and 2006/2007 fiscal years. It follows a similar format to the 2007 report, which covered the 2003/2004 and 2004/2005 fiscal years. The two reports may be read in conjunction, as the first one provides a great deal of contextual information not repeated in this current report. The 2007 report is found online at http://www.health.gov.bc.ca/pho/pdf/WaterReport.pdf.

For more information on the Action Plan for Safe Drinking Water in British Columbia, see the introduction to the 2007 report or download the Action Plan from the Government of British Columbia website at: http://www.health.gov.bc.ca/cpa/publications/safe_drinking_printcopy.pdf.

Drinking Water in British Columbia

The *Drinking Water Protection Act* applies to all water supply systems in the province that serve more than one single family residence. While the province is home to more than 4,500 drinking water systems (see Table 1), the vast majority of these serve very few people. The Act also prohibits tampering with or contaminating domestic water systems that serve single family residences.

Most British Columbians live in urban centres and receive high-quality drinking water from a few large drinking water suppliers. Water suppliers serving these larger urban areas, as well as some of the smaller centres, are staffed by professionals including professional engineers and certified operators who are well qualified to provide the public with the highest quality water possible. When water quality concerns do arise, these suppliers have systems in place to notify their consumers and to correct any problems.

Click for Table 1 data

Table 1 Number of recorded drinking water systems in the province, by health authority, as of March 31, 2007

Health authority	Number of drinking water systems
Vancouver Coastal	279
Fraser	484
Vancouver Island	945
Interior	1,778
Northern	1,105
Total	**4,591**

Note: Given that data in the report was provided at different times and that the number of water systems changes periodically, there may be slight variations in the numbers of water systems discussed in the report.

The *Drinking Water Protection Act* and regulation recognize that drinking water supplies are best protected using a multi-barrier approach, from source to tap. Protection is achieved through a multi-step process that gathers information about each water supply system through inspections, assessments, and water monitoring, and then puts barriers in place to stop potential contaminants from entering the drinking water supply.

Some water suppliers serve high-quality groundwater that requires no treatment to make it safe to drink. However, water from some wells or from any surface water source must be treated. Treatment may include filtration and then disinfection, or just disinfection using chlorine, chloramines, ultraviolet irradiation, or ozonation. Drinking water officers work with water suppliers to ensure drinking water is adequately treated or that plans are in place to improve water treatment, where necessary.

Table 1 shows the breakdown of the 4,591 water systems in British Columbia by health authority. An additional 357 drinking water systems serve First Nations communities on reserve. The total number of systems changes as new systems are created, as existing unregulated systems are located by drinking water officers, and as other systems are amalgamated or stop serving the public when the business they are associated with closes (such as a restaurant or a campground). Note that some data presented in this report were compiled at different times of the year and may show a different total number of systems.

British Columbians who live in small communities or remote areas, or who are served by water from their own wells, are generally the ones who face challenges with their water supplies. For these suppliers, challenges can include:

- Inadequate treatment.
- Trouble attracting and retaining trained and certified operators.
- Difficulty in accessing laboratory services in a timely manner for testing water samples for *Escherichia coli (E. coli)* and total coliform bacteria.
- Lack of funding support for making improvements to infrastructure.

As described throughout this report, progress is being made to address all of these challenges. In many cases this progress is slow.

Province-wide, information management and reporting is a major ongoing challenge. Water suppliers collect data about their water supplies through their monitoring and testing programs, and this information is shared with drinking water officers from the local regional health authority. Each health authority has databases where this information, and other data they collect, are stored. Likewise, provincial government ministries and agencies also collect information about water in the province, whether it relates to land use (urban development, forestry, agriculture, mining, or other industrial activities) or environmental monitoring. These data are again stored in various databases. Ideally, the information in all of these databases would be shared for the benefit of all parties. Such sharing would also make it much easier to chart progress in achieving the objectives of the Action Plan for Safe Drinking Water in British Columbia and the *Drinking Water Protection Act* and regulation. Initiatives to resolve data management challenges have not yet met with success. These data management initiatives are described in more detail in Section 3.

Accountability

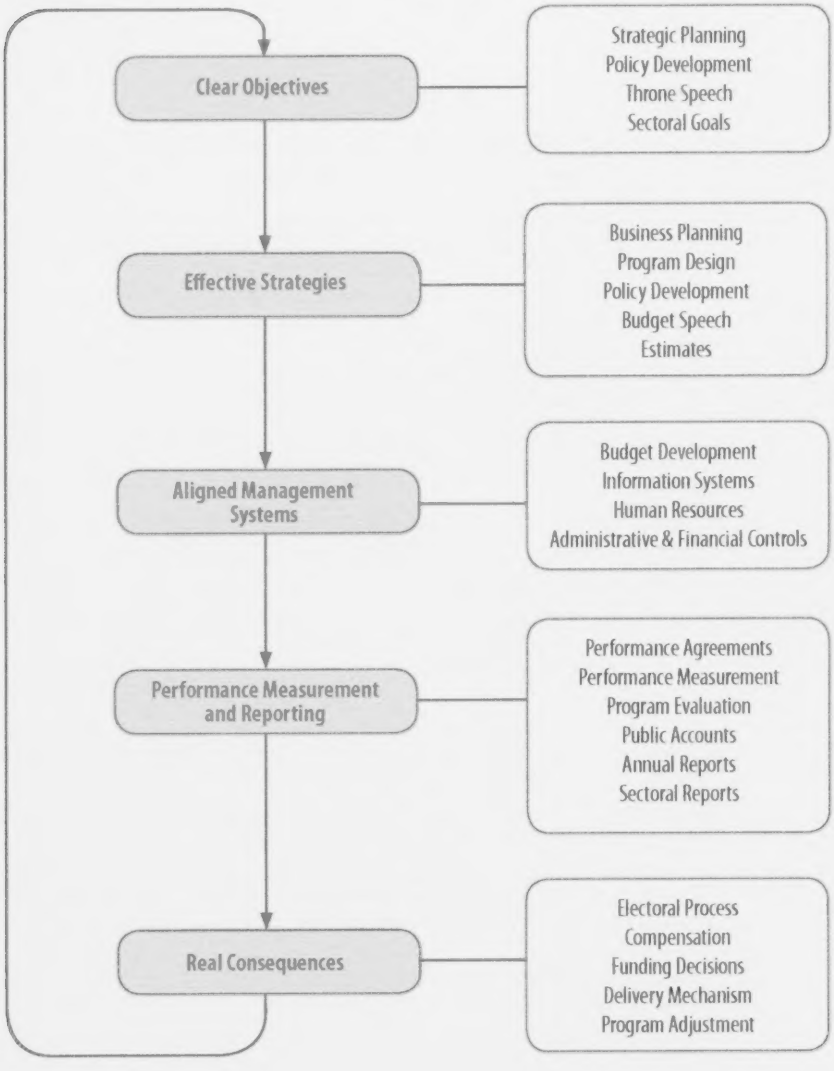
The 2007 report *Progress on the Action Plan for Safe Drinking Water in British Columbia*, which covered the fiscal years 2003/2004 and 2004/2005, set out and followed an accountability framework that would allow the Provincial Health Officer to chart progress on drinking water issues in the province over many years. This framework was based on one developed by the Auditor General of British Columbia and is used again for this report. Figure 1 shows this basic framework.

For the purpose of reporting on progress on the Action Plan for Safe Drinking Water in British Columbia, the clear objectives in both the last report and this one are the Action Plan's eight principles:

1. The safety of drinking water is a public health issue.
2. Source water protection is a critical part of drinking water protection.

3. Providing safe drinking water requires an integrated approach across all the ministries and agencies that have legislated authority for water protection from source to tap.
4. All water systems need to be thoroughly assessed to determine risks.
5. Proper treatment and water distribution system integrity are important to protect public health.
6. Tap water must meet acceptable safety standards and be monitored.
7. Small systems require a flexible system with safeguards.
8. Safe drinking water should be affordable, with users paying appropriate costs.

Figure 1 Accountability Framework



Source: *Enhancing Accountability for Performance: A Framework and an Implementation Plan*. Auditor General of British Columbia, 1996.

For ease of reporting and reading, each of these eight principles is discussed in its own numbered section in this report. For each objective, progress is detailed under the headers of Effective Strategies, Aligned Management Systems, and Performance Measurement and Reporting. These categories cover the following types of topics:

- **Effective Strategies:** Legislative and regulatory changes, policies, political priorities.
- **Aligned Management Systems:** Budgets, information systems, human resources, administration and financial controls.
- **Performance Measurement and Reporting:** Performance measurement, program evaluation, public accounts, annual reports, reports from various sectors (government agencies, industry, non-profit organizations, etc).

The final section of this report looks at the recommendations made in the 2007 report and discusses both progress made to date and ongoing challenges that require further commitments or actions in order to be addressed. In future years, as actions are taken to fill these gaps and address the challenges, they will be reported on within the appropriate section of the accountability framework. New recommendations will likely emerge as programs and policies evolve.

Section 1: Public Health Protection

Access to clean, safe, and reliable sources of drinking water remains a basic tenet of public health protection. In British Columbia, the Ministry of Health[4] is the lead provincial ministry responsible for drinking water. It works closely with other government ministries, the health authorities, and water supply organizations to make sure public health is protected from threats to drinking water.

During the reporting period (fiscal years 2005/2006 and 2006/2007), regulatory amendments were made to better protect public health. Changes to the Drinking Water Protection Regulation clarified who is responsible for disinfecting drinking water supplies, required water samples to be tested for both *Escherichia coli (E. coli)* and total coliforms, and enabled better reporting of water sample testing results. Changes to the Violation Ticket Administration and Fines Regulation improved enforcement of the *Drinking Water Protection Act* and regulation by making it possible for drinking water officers and others to issue tickets for violations.

All drinking water officer positions in the health authorities are now filled. To support drinking water officers in carrying out their duties, the Ministry of Health provided guidance on how to use the *Drinking Water Officers' Guide* (amended during the reporting period) as well as training during an annual conference. Drinking water officers also attended educational workshops. To fund this training and education, the provincial government provided $1 million per year to the five regional health authorities ($200,000 each).

Between April 1, 2005, and March 31, 2007, three new laboratories received approval from the Provincial Health Officer to test the bacteriological quality of drinking water samples. These new laboratories expand coverage in remote and underserved areas of the province, giving water suppliers in the North and East Kootenays a better chance of getting their water samples to an approved laboratory within the required 30 hours of sample collection. As part of the effort to continuously improve laboratory services in the province, the Enhanced Water Quality Assurance Program conducted and reviewed 18 laboratory audits and improved auditing tools.

While no outbreaks of waterborne disease were reported, water suppliers did issue water quality advisories and boil water notices in approximately 10 per cent of communities around the province. The majority of these water systems were small and served a combined estimated 1 per cent of the province's population.

While water suppliers generally do a good job of notifying the public of water quality concerns, data collection and reporting at a regional and provincial level continues to be inadequate. Data collection and reporting challenges may eventually be

[4] *In 2008, the responsibility for the Drinking Water Protection Act was transferred to the Ministry of Healthy Living and Sport.*

resolved through the drinking water information initiative and the BC-Yukon public health information project, but further commitment from the government is required. Progress on these issues and challenges is described in more detail in the pages that follow.

1.1 Effective Strategies

Amendments to the Drinking Water Protection Regulation

The Drinking Water Protection Regulation was amended in December 2005. Most of the amendments made the regulation more flexible for small water systems while continuing to protect public health. The changes that specifically relate to public health:

- Clarify that the water supply owner is the party responsible for disinfecting water supplies.
- Enable drinking water officers to require laboratories to report, on request, all water samples received and testing results to the drinking water officer or water supply system owner, regardless of whether the samples test positive for *E. coli* bacteria. (For more information, see Section 6.1)
- Remove the option for water samples to be tested for fecal coliform bacteria rather than *E. coli*, while maintaining the requirement to test for total coliform bacteria. The presence of *E. coli* is a better indicator of contamination from fecal matter than fecal coliforms.

Amendments related to drinking water treatment and distribution, drinking water quality, and small systems are discussed in Sections 5.1, 6.1, and 7.1 of this report, respectively.

Amendments to the Violation Ticket Administration and Fines Regulation, pursuant to the *Offence Act*

On May 4, 2006, the Violation Ticket Administration and Fines Regulation was amended to allow medical health officers, drinking water officers, or public health inspectors to issue tickets for specified violations of the *Drinking Water Protection Act* and the Drinking Water Protection Regulation.

Prior to this amendment, offences under the *Drinking Water Protection Act* could only be addressed through prosecution, with provisions upon conviction allowing for a fine of up to $200,000 or imprisonment for up to one year, or through additional sentencing provisions under Section 104.1 of the *Health Act*.

Offences named in this amendment relate to improper construction and operation of a water supply system, failure to have adequately qualified personnel, failure to meet monitoring or public notification requirements, failure to comply with orders, failure to disinfect surface water or groundwater at risk of containing pathogens that could contaminate drinking water, and tampering with a water supply system. Although the fines are relatively low ($345 to $575), a person can be issued repeat tickets if they continue to offend. This provision can be a useful enforcement tool for drinking water officers.

These fines expand on previous ticketable offences related to violations of the Sanitary Regulations pursuant to the *Health Act*. These regulations make it possible to fine landlords who fail to provide sufficient safe and potable water to tenants and to fine anyone who contaminates water used for domestic purposes. The fine for violating the Sanitary Regulations is $115. A $345 fine can be issued to anyone who fails to comply with an order issued under the *Health Act*.

To date, no tickets have been issued under the *Drinking Water Protection Act*, although some water suppliers have been fined for failing to comply with an order issued under the *Health Act*.

The Violation Ticket Administration and Fines Regulation can be found online at http://www.qp.gov.bc.ca/statreg/reg/O/Offence/Offence89_97/89_97_03.htm#Schedule2. The Provincial Fines Booklet (http://www.pssg.gov.bc.ca/police_services/publications/other/finesbooklet2007.pdf) includes the complete list of ticketable offences under both the *Drinking Water Protection Act* and the *Health Act*.

Guidelines, Directives, Special Committees, and Reports

On March 23, 2006, the Minister of Health issued an order under Section 4 of the *Drinking Water Protection Act* that made the *Drinking Water Officers' Guide* a guideline that must be considered by drinking water officers in carrying out their duties. The guide is a comprehensive guidance document intended to ensure drinking water officers and their delegates across the province are consistent in exercising

their authority under the *Drinking Water Protection Act* and do so in accordance with principles of administrative fairness.

On March 28, 2007, a further ministerial order amended the guide and established that the guide could be further amended from time to time without the need for an order.

The *Drinking Water Officers' Guide* can be found at http://www.health.gov.bc.ca/protect/dwoguide_updated_approved%202007.pdf.

The Minister did not establish any special drinking water advisory committees during the reporting period.

The Provincial Health Officer released the first report on progress on the Action Plan for Safe Drinking Water in British Columbia in early 2007. It can be downloaded from the Ministry of Health website at http://www.health.gov.bc.ca/pho/pdf/WaterReport.pdf.

Drinking Water Officer Positions in the Regional Health Authorities

As described in the previous report, each regional health authority has hired designated drinking water officers and/or has delegated drinking water officer responsibilities to various staff people. The number of drinking water officers, delegates, and support staff varies between the health authorities (based on the number of water supply systems in the region), as does the organizational structure within which they operate.

The responsibility for administering the *Drinking Water Protection Act* often forms only one part of a designated person's duties, with the rest of their duties defined by other provincial or federal legislation such as the *Health Act*, *Food Safety Act*, *Community Care and Assisted Living Act*, *Tobacco Control Act*, and *Tobacco Act*. Table 2 summarizes the number of full-time equivalent staff positions dedicated to regional drinking water programs. The total number of full-time equivalent staff of 82.20 is an increase of 22.44 staff more than reported in 2004/2005.

1.2 Aligned Management Systems

Drinking Water Officer Training and Support

In both 2005/2006 and 2006/2007, the Ministry of Health provided the five regional health authorities with $1 million in funding for drinking water officer training. Each health authority received $200,000.

This funding was used to sponsor an annual conference for drinking water officers, hosted by a different regional health authority each year. Remaining funds were used for additional training such as attending conferences and workshops and taking courses available through universities. In 2005, the Interior Health Authority hosted the conference in Kamloops. The Vancouver Coastal Health Authority hosted the 2006 conference in Vancouver, which attracted 87 participants.

Click for Table 2 data

Table 2 Number of Full-Time Equivalent (FTE) staff working as, or supporting, drinking water officers

	FTEs by type of position						
Health Authority	**Medical Health Officers**	**Public Health Inspectors**	**Management**	**Technical***	**Public Health Engineers**	**Clerical**	**Total**
Vancouver Coastal	0.40	3.50	0.35	0.90	1.50	0.75	7.40
Fraser	0.50	6.00	1.05	2.05	1.00	1.40	12.00
Vancouver Island	0.60	6.00	3.00	2.00	1.80	3.00	16.40
Interior	1.00	20.00	2.00	7.00	4.00	5.00	39.00
Northern	0.40	5.00	0.30	0	0.70	1.00	7.40
Total	**2.90**	**40.50**	**6.70**	**11.95**	**9.00**	**11.15**	**82.20**

Note: *Includes technical specialists and water samplers

Some of these participants were from provincial government ministries and agencies. The conference agenda covered standards and certification for point-of-entry and point-of-use treatment devices; the use of these devices in BC; risk assessment methods and applications; the evaluation of cross-connection control programs; and questions surrounding legal obligations and liabilities for regulators.

In January 2006, the Drinking Water Leadership Council completed the *Drinking Water Officers' Guide*. This policy guide was developed to support drinking water officers in carrying out their duties. It covers roles and responsibilities; the scope of the *Drinking Water Protection Act*; construction and operating permits; the ongoing functions of drinking water officers, including routine monitoring, inspections, investigations, and reports; decision making; the application of other legislation and regulations; and the relationship between drinking water officers and officials from other agencies. The publication of this guide fills a gap identified in the previous progress report. As mentioned in Section 1.1, the guide has been established by the Minister as a guideline that must be considered by drinking water officers in carrying out their duties. Workshops were held during the reporting period to introduce the guide to officers.

Turbidity in Metro Vancouver

Metro Vancouver (formerly the Greater Vancouver Regional District) receives its drinking water from three protected watersheds: Seymour, Capilano, and Coquitlam. No residential, industrial, recreational, or agricultural activities occur in these watersheds, thus reducing the risk of source water contamination.

Water from all three locations is disinfected with chlorine, to kill bacteria and viruses, prior to distribution to consumers. The *Guidelines for Canadian Drinking Water Quality* also recommend that drinking water from surface water sources be filtered to remove parasitic cysts and oocysts that are relatively resistant to disinfection with chlorine. Water supplies that meet criteria demonstrating that the source water will be adequately treated without filtration can be exempted from this requirement. Based on recommendations from medical health officers in the Vancouver Coastal and Fraser health authorities, Metro Vancouver is building a $600 million filtration plant on the North Shore, due to come on-line in 2009.

Because low levels of parasitic cysts and oocysts are normally found in the Metro Vancouver watersheds—although normally not at levels thought to be of concern to the healthy population—those with compromised immune systems living in Metro Vancouver are advised to consider drinking only boiled water or appropriately treated bottled water at all times. The Provincial Health Officer has issued a similar advisory to people whose immune systems are compromised, regardless of where they live in the province. This advisory is particularly important for such people who are supplied with unfiltered surface water.

Turbidity is a measure of cloudiness in the water, and rises as silt and other material is washed into the water. Source water turbidity is of concern because it:

- May interfere with disinfection, increasing the risk of bacterial or viral contamination in water reaching the end user.
- May be associated with an increase in bacteria, viruses, or parasitic cysts and oocysts excreted by animals, as these may have been washed into the water with silt and other material.

The degree to which turbidity will interfere with disinfection or be associated with pathogens varies with the source of turbidity. Turbidity resulting from suspended clay is less likely to interfere with disinfection than turbidity from organic material such as decaying leaves. Because pathogens are more common near the surface of the ground than deeper within it, turbidity resulting from landslides or stream bank erosion can reach high levels without being associated with a significant increase in bacteria, viruses, or parasites. Conversely, if an animal defecates directly into a water source, a large number of pathogens can be present in relatively clear water (no noticeable turbidity).

A study conducted by Metro Vancouver medical health officers and Health Canada in 2000 found that the risk of gastrointestinal illness in consumers of Metro Vancouver drinking water increased as source water turbidity increased. This study concluded that risk increased as turbidity levels rose above 1 NTU (nephelometric turbidity units).

Extreme weather events, such as high rainfall, have also been linked to waterborne disease outbreaks. In November 2006, unprecedented rainfalls on the West Coast led to multiple mudslides in the three Metro Vancouver watersheds. Consequently, turbidity rose to levels never seen before: more than 100 NTU in the Seymour watershed, more than 70 NTU in the Capilano watershed, and nearly 10 NTU in the Coquitlam watershed. No *E. coli* were present in water samples, and tests for *Giardia* and *Cryptosporidium* showed no indication of unusual parasite contamination of the drinking water. In addition, there was no evidence of an outbreak of disease. Since it takes about a day to test samples for bacteria, and even longer for *Giardia* and *Cryptosporidium*, it is always possible for them to be present in water even though the previous day's test results showed no concern. Similarly, it can take several days for an outbreak of disease to appear after a community is exposed, since people who are infected do not have immediate symptoms.

Given the extreme levels of turbidity and concern about the potential increased risk of illness, medical health officers initiated a boil water advisory on November 16, 2006. The medical health officers advised the general public to either boil their water, which would kill any organisms, or to drink bottled water. Hospitals, care facilities, and day cares were ordered to provide either bottled or boiled water to vulnerable patients and children.

Medical health officers, environmental health officers, and Metro Vancouver municipal engineers worked together closely during the boil water advisory to monitor turbidity, to increase water testing throughout the affected municipalities to monitor for potential contamination, and to maintain surveillance for any disease outbreaks. Within 24 hours, Metro Vancouver engineers were able to preferentially supply lower turbidity water from the Coquitlam watershed to most of the Metro Vancouver area, which led to the advisory being lifted for half of those affected by November 17, 2006. For the remaining municipalities, including Vancouver, the North Shore, and Burnaby, the boil water advisory remained in effect for an additional ten days.

Vancouver Coastal Health Authority staff, including those working in the environmental health, emergency management, purchasing, and health care fields, worked hard to ensure that bottled or boiled water was available to patients in hospitals and care facilities and to vulnerable patients in the community receiving home support services. Communications staff in the Vancouver Coastal Health Authority worked with the medical health officers and the media to ensure accurate, timely information was available to the public. On November 27, 2006, with turbidity on a steady downward trend and extensive monitoring over the previous 11 days indicating that bacterial and protozoan levels in both the source and treated water were at normal levels, the boil water advisory was lifted.

Throughout the entire period of high turbidity, there were no significant counts of *Giardia* or *Cryptosporidium* cysts or oocysts. Only one positive *E. coli* sample, believed to have resulted from a contaminated sample collection jar, was collected. The Medical Service Plan (MSP) billings for enteric disease showed no significant increase during the period of elevated turbidity.

During the first day or two of the event, there was some confusion about what message should be given to the public. There were also some failures in communication. Area medical health officers continue to work with Metro Vancouver to evaluate and learn from this unprecedented event, in order to be better prepared for any future drinking water concerns. In particular, a new surveillance program has been implemented across the province to track MSP billings data on a daily basis. This tracking may serve as an early warning system for enteric disease outbreaks.

1.3 Performance Measurement and Reporting

Waterborne Disease

No outbreaks of waterborne disease were reported between April 2005 and March 2007. However, individual British Columbians were affected by enteric, or gastrointestinal, diseases from pathogens such as *Campylobacter*, verotoxigenic *E. coli*, *Cryptosporidium*, *Giardia*, and *Salmonella*. Each year in BC, more than 5,000 cases of enteric disease are reported to the health authorities. For each case reported, an estimated 347 cases go unreported in the community. Many affected individuals neither consult a health care provider about their symptoms nor get a laboratory-confirmed diagnosis. These pathogens can be spread in many different ways, including through drinking water. People may also have been exposed to these pathogens during international travel, from pets or other animals, in food or water, or through person-to-person contact.

In outbreak situations, epidemiological surveys can identify common sources of exposure. Outside of these situations, however, it is difficult to assess the source of exposure because:

- Enteric infections are underreported. Cases that have a common source may not all come to the attention of physicians and, therefore, medical health officers. If cases are unknown, the link to the source of pathogens may not be made.
- People have many opportunities to become exposed from more than one source of pathogens during the pathogen's incubation period. This makes it hard to pinpoint which source may have been the problem, particularly where small numbers of people are known to be affected.
- Drinking water contamination may be time-limited but exposure to drinking water is continuous, making it difficult to identify a specific time when a person might have been exposed.
- People within a community tend to drink water from the same source, making it difficult to find an appropriate comparison group to rule out other sources.
- Follow-up on enteric infections by public health officials differs by pathogen and by region.

In BC, public health authorities attempt to follow-up on each case of *Salmonella* and verotoxigenic *E. coli* infection. Follow-up is done primarily to assess whether the person works in a high-risk setting (such as food handling) and must be temporarily excluded from work and to assess links between cases in an outbreak situation. The information collected at the local level is not routinely collated provincially, unless an outbreak is occurring. In most health authorities, individual cases of *Campylobacter*, *Giardia*, and *Cryptosporidium*

infection are not routinely followed-up in the same way because the resources required would be too onerous and the risk of the infection spreading from person-to-person is low.

If an outbreak occurs with any of these pathogens, people infected would be contacted to assess common exposures. That said, even after a thorough interview with an infected individual, it is often difficult to attribute illness to a particular source (such as travel, food or water). The only exposure that can be objectively measured is international travel. A pilot project conducted in one region of BC demonstrated that a large proportion of enteric infections in 2002 to 2006 (20–80 per cent) were acquired when people travelled internationally.

No Canadian or international jurisdiction has been able to accurately measure the source of individual enteric infection. However, researchers have attempted to estimate the proportion of locally-acquired illness due to food and water. Based on these estimates, the proportion of locally-acquired reported cases that may be attributed to drinking water in a North American setting such as BC could range from as low as 5 per cent for non-typhoidal *Salmonella* infection to as high as 90 per cent for *Cryptosporidium* infection. The United States Environmental Protection Agency used modeling to estimate that in the US, 8.5 per cent of episodes of diarrhea in a community may be attributed to drinking water. Based on five randomized clinical trials of drinking water interventions, another group of researchers estimated that about 12 per cent of gastrointestinal illness could be attributed to drinking water in those settings. These estimates will vary according to many factors, including the source of water, the type of water treatment, its monitoring, the distribution system, and the population served.

Table 3 shows the number of cases of selected enteric diseases reported in BC in the 2005 and 2006 calendar years.

Figures 2 through 6 show the rates of these enteric diseases between 1998 and 2007.

Click for Table 3 data

Table 3 Cases of enteric diseases reported in BC, 2005 and 2006

Enteric disease	2005	2006
Campylobacteriosis	1569	1586
Giardiasis	691	672
Cryptosporidiosis	124	130
Verotoxigenic *E. coli* infections	115	150
Salmonellosis	739	705
Total	**3,238**	**3,243**

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Campylobacteriosis

Research shows that between 75 per cent and 80 per cent of cases of campylobacteriosis are foodborne, though infection can be transmitted by waterborne *Campylobacter* if the water is contaminated with fecal material and is not adequately treated.

Campylobacteriosis remains the most commonly reported enteric disease in British Columbia with a total of 1,586 cases in 2006. The number of reported cases in 2006 is similar to the numbers reported in 2005 and 2004. It remains higher than the national incidence. The downward trend that began after 1998 stabilized in 2004.

There were marked regional differences in the rate of reported *Campylobacter* infections. As in past years, the highest rates of infection were reported in areas in the south of the province; rates ranged from 40.9 to 54.3 cases per 100,000 population. There was a marked increase in rates of infection reported in East Kootenay and the Northwest compared to previous years. No outbreaks were reported.

The usual peak in the rate of reported infections in children aged 1 to 4 years was not as distinct in 2006. The highest rates of infection were reported among females aged 20 to 24 years (62.7/100,000) and males aged 1 to 4 years (59.9/100,000). Reasons for this are not clear.

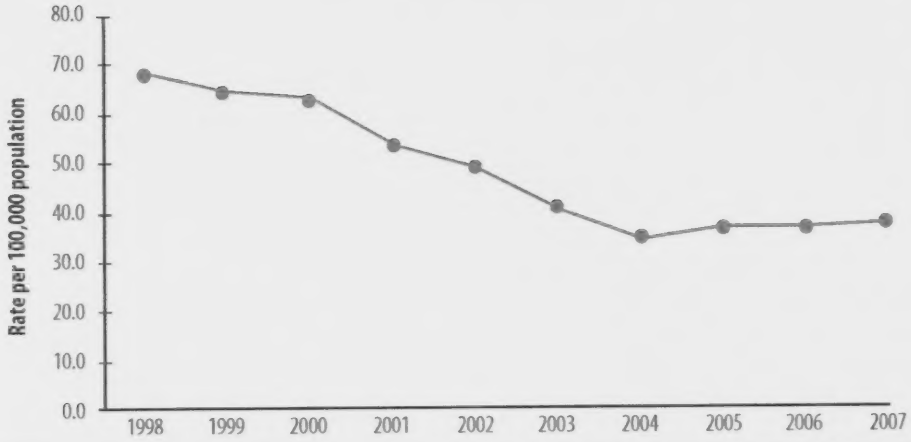
Cryptosporidiosis

Rates of cryptosporidiosis in BC typically exceed the national average, with the highest rates each year occurring consistently in Fraser East. Infections are more common in children under 5 years of age. Infection with *Cryptosporidium parvum* displays a seasonal pattern, with a peak in the late summer and early fall. No outbreaks were reported in 2006.

Click for Figure 2 data

Figure 2

Campylobacteriosis Rates by Year, 1998 - 2007



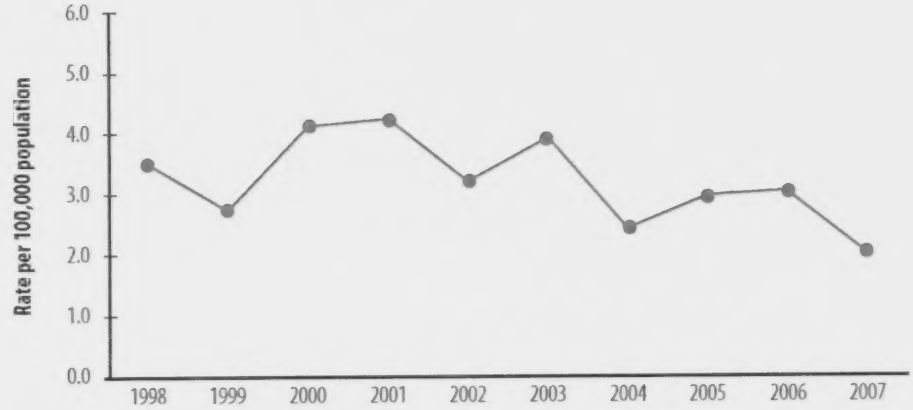
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BC Campylobacteriosis Reports	2760	2612	2583	2193	2052	1712	1471	1569	1586	1640
BC Campylobacteriosis Rate	69.3	65.1	64.0	53.8	49.9	41.2	35.0	36.9	36.8	37.6

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Click for Figure 3 data

Figure 3

Cryptosporidiosis Rates by Year, 1998 – 2007



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BC Cryptosporidiosis Reports	139	109	167	173	130	162	100	124	130	87
BC Cryptosporidiosis Rate	3.5	2.7	4.1	4.2	3.2	3.9	2.4	2.9	3.0	2.0

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Verotoxigenic E. coli

Reporting of verotoxigenic *E. coli* infection increased slightly in 2006 compared to 2005, with a total of 150 cases (3.5 per 100,000 population). For the third consecutive year, incidence remained higher than the national reported incidence. The highest rates were reported in children aged 1 to 4 years.

The highest regional rates were reported in South Vancouver Island, Thompson Cariboo Shuswap, Okanagan, Fraser North, and East Kootenay, with rates from 3.6 to 7.4 cases per 100,000.

All cases of verotoxigenic *E. coli* infection should be followed up in BC. Research shows that 65 per cent to 85 per cent of cases are foodborne. The rest could either be spread through person-to-person contact or by contaminated water. The number of remaining cases that could have been waterborne is unknown, though there were no known outbreaks of waterborne *E. coli* infection during the reporting period.

Giardiasis

Annual rates of giardiasis in BC have decreased over the last decade. In 2006, incidence was lower than usual with no seasonal peak and no outbreaks detected. The highest rates of infection were reported in children aged 1 to 4 years and adults aged 20 to 29 years. Sixty per cent of cases occurred among males. Geographically, the Vancouver and Fraser East health service delivery areas experienced the highest rates of infection at 26.3 and 24.9 per 100,000 population, respectively.

The downward trend may be due to initiatives aimed at improving food safety, traveller safety, or drinking water safety in BC.

Salmonellosis, Typhoid Fever, and Paratyphoid Fever

In 2006, 705 cases of *Salmonella* infection were reported for a rate of 16.4 per 100,000. In the last few years, the rate of salmonellosis has remained relatively constant in BC and similar to the Canadian rate. Rates were highest in children under 5 years of age and similar overall in males and females. Rates were highest in the Vancouver Coastal Health Authority. No known outbreak was associated with these peaks. No large inter-regional outbreaks were reported in 2006.

In 2006, 28 cases of S. Typhi were reported for a rate of 0.7 per 100,000. The rate of S. Paratyphi infection continues to increase with 50 cases (1.2 per 100,000) reported in 2006. Most cases of S. Typhi and S. Paratyphi were reported from Fraser Health Authority and were associated with travel to India.

Click for Figure 4 data

Figure 4

Verotoxigenic *E.coli* Infection Rates by Year, 1998 – 2007

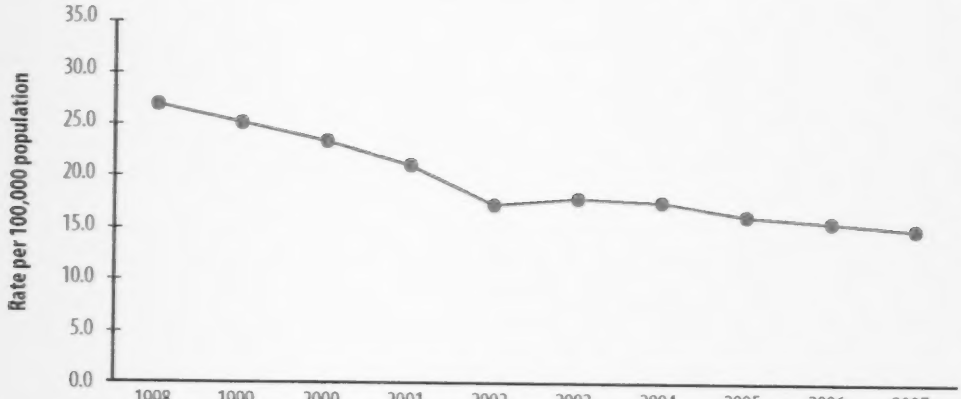
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BC Verotoxigenic E.coli Reports	185	287	166	137	138	123	193	115	150	183
BC Verotoxigenic E.coli Rate	4.6	7.2	4.1	3.4	3.4	3.0	4.6	2.7	3.5	4.2

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Click for Figure 5 data

Figure 5

Giardiasis Rates by Year, 1998 – 2007



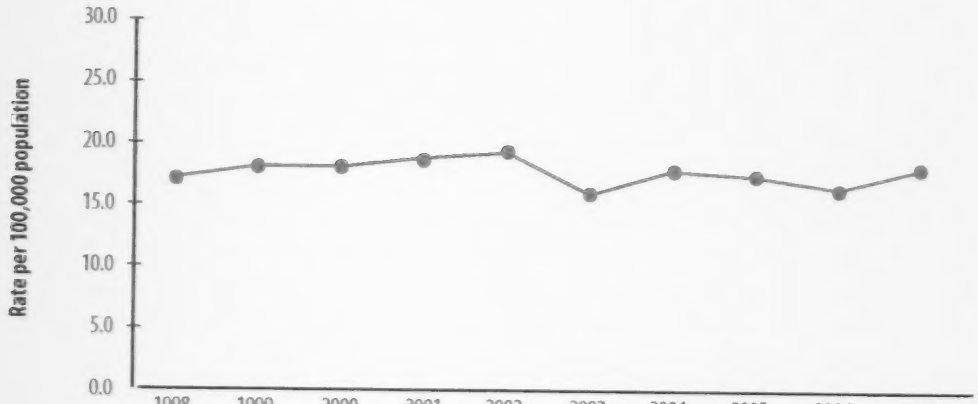
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BC Giardiasis Reports	1075	1009	941	860	710	742	739	691	672	649
BC Giardiasis Rate	27.0	25.2	23.3	21.1	17.3	17.9	17.6	16.2	15.6	14.9

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Click for Figure 6 data

Figure 6

Salmonellosis Rates by Year, 1998 – 2007



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
BC Salmonellosis Reports	679	725	727	763	789	660	749	739	705	790
BC Salmonellosis Rate	17.1	18.1	18.0	18.7	19.2	15.9	17.8	17.4	16.4	18.1

Source: 2007 Epidemiology Report: 2007 British Columbia Annual Summary of Reportable Diseases. BC Centre for Disease Control, November 2008. Available at http://www.bccdc.org/content.php?item=33

Public Notification or Advisories Related to Water Quality

Water suppliers are responsible for notifying the public about water quality concerns.

Water quality advisories or boil water notices may be issued for a number of reasons, or a combination thereof:

- Significant deterioration in source water quality.
- Equipment malfunction during treatment or distribution.
- Inadequate disinfection or disinfectant residuals.
- Unacceptable microbiological quality.
- Unacceptable levels of turbidity or particle counts.
- Public health compromised by poor system operation.
- Epidemiological evidence that the drinking water is or may be responsible for an outbreak of illness.

After the *Drinking Water Protection Act* was promulgated in May 2003, drinking water officers began re-evaluating programs that encourage public awareness of water quality problems. As public notification procedures have changed, the value of tracking the number of boil water advisories as a way of assessing the overall performance of drinking water programs has become questionable. In particular, the increase of water quality advisories and notices over time should not be seen as a reflection of decreased water quality.

Tracking the number of boil water advisories can be misleading because the proportion of systems under advisories does not reflect the proportion of the population affected. Most of the long-term advisories in the province are on public water supply systems with 1 to 300 connections, serving an estimated 1 per cent of the total population in BC. The focus on reducing the number of boil water advisories undermines the fundamental purpose of an advisory, which is to inform specific communities about concerns related to the quality of their drinking water. Further, one of the primary reasons that the number of advisories and notices increases over time is the discovery of water systems that are not adequately treating their water. The 2007 report, *Progress on the Action Plan for Safe Drinking Water in British Columbia*, identified 393 boil water advisories or notices in effect in November 2003. By November 2006, the number had increased by 87 to 480. However, the total number of systems regulated by drinking water officers had increased from 3,957 to more than 4,500. While improvements have been made, more can clearly be done to improve water treatment, reduce the need for boil water advisories in the province, and minimize the need for individuals to boil their water as a *de facto* form of water treatment.

The total number of water supply systems on boil water advisories in 2006 was 480, essentially unchanged from the 488 advisories in effect in 2005 (see Tables 4 and 5). At the time the 2005 data was collected, the total number of reported water supply systems in the province was 4,432; approximately 11 per cent were under advisories. When the boil water advisory count was undertaken in 2006, no data was collected on the total number of systems in the province. Based on the data provided at the end of the fiscal year, the number of systems could have been as high as 4,591. This suggests that 10 per cent of systems were under advisory in 2006, or roughly the same percentage as were in place in 2003 (393 advisories or notices out of 3,957 systems).[5] More importantly, the increase in the number of water systems under regulation between November 2005 and March 2007 (approximately 150 systems) largely reflects the discovery of existing, non-compliant systems which drinking water officers placed on advisory or notice once they became aware of them.

While water suppliers generally do a good job of notifying the public of water quality concerns, at a regional and provincial level, data collection and reporting related to public notifications and advisories continues to be inadequate. For instance, three of the regional health authorities exclusively use an information management system called HealthSpace. A fourth, the Vancouver Coastal Health Authority, uses it in the Coast Garibaldi region. The HealthSpace system allows the health authority to post information about water quality advisories and boil water notifications, as well as results of inspections, on a website,[6] but the system lacks a

[5] *As reported in the 2007 report*, Progress on the Action Plan for Safe Drinking Water in BC.

[6] *The HealthSpace websites for the four regional health authorities using the software are: Northern Health Authority: http://www.healthspace.com/nha. Vancouver Island Health Authority: http://www.healthspace.com/viha. Fraser Health Authority: http://www.healthspace.com/fha. Vancouver Coastal Health Authority: http://www.healthspace.com/vch.*

comprehensive tracking and reporting function. So, while it is possible to compile a snapshot of advisories and notifications in place throughout much of the province on a given day, it is not possible to easily track these advisories and notifications over time. Thus, on March 31, 2007, it was possible to see that the Vancouver Coastal Health Authority had 29 advisories in the Coast Garibaldi region: 23 due to positive microbiological samples and six because of high levels of turbidity. However, it is not readily apparent how many advisories were issued over the course of the year, how long each one lasted, how many new advisories were issued or how many longstanding advisories were removed.

During the reporting period, the upper coastal and Metro Vancouver portions of the Vancouver Coastal Health Authority were not posting water quality advisories and boil water notices on a website (though individual water suppliers may have done so). Like the fifth regional health authority, Interior Health Authority, this portion of Vancouver Coastal Health Authority does not use the HealthSpace system but rather a data management system known as Hedgehog (which was slated to be converted to a Decade Hedgehog/Envision Connect system in 2008). The Interior Health Authority does post boil water notices on its website,[7] but this list is somewhat problematic, as it is not linked to a live database and it is updated only periodically.

Tables 4 through 8 show the number of water quality advisories and boil water notifications in place when the Ministry of Health surveyed health authorities and Health Canada's First Nations and Inuit Health Branch in November 2005 and November 2006.

Tables 4 and 5 show that the majority of boil water advisories in effect during the reporting period were on small systems serving fewer than 500 people each. Of the 488 advisories in effect in November 2005, only 15 affected populations of more than 500. In November 2006, 16 advisories affected populations of more than 500.

Click for Table 4 data

Table 4 Boil water advisories* in effect by population on November 1, 2005**

	Vancouver Coastal	Vancouver Island	Interior	Fraser	Northern	Total Advisories
Pop. ≥ 500	3	0	12	0	0	15
Pop. <500	50	77	255	34	57	473
Total advisories	**53**	**77**	**267**	**34**	**57**	**488**

Notes: * Boil Advisories reported include reported "advisories" and "notifications."
** Table was compiled November 1, 2005, but data provided by health authorities may not include recent updates (either rescinding or initiating advisories). Does not include data from First Nations communities.

Click for Table 5 data

Table 5 Boil water advisories* in effect by population on November 15, 2006**

	Vancouver Coastal	Vancouver Island	Interior	Fraser	Northern	Total Advisories
Pop. ≥ 500	3	0	12	1	0	16
Pop. <500	48	54	288	26	48	464
Total advisories	**51**	**54**	**300**	**27**	**48**	**480**

Notes: * Boil Advisories reported include reported "advisories" and "notifications."
** Table was compiled November 15, 2006, but data provided by health authorities may not include recent updates (either rescinding or initiating advisories). Does not include data from First Nations communities.

[7] *The website for Interior Health Authority can be found at http://www.interiorhealth.ca/health-and-safety.aspx?id=536.*

These numbers should only be read as a "snapshot" of the situation as they are based solely on information provided by the health authorities in November of each year. They do not capture fluctuations in the number of short-term advisories around the province, including some issued for larger communities as a result of elevated turbidity. For example, the boil water advisory for residents in the Metro Vancouver area was issued in November 2006 after the tables were compiled. That advisory affected most municipalities in the region and almost 2 million people but lasted only 12 days. These kind of turbidity-related advisories are issued in communities throughout the province, especially during spring snowmelt in the Interior or heavy fall rainfalls on the coast. Such advisories are generally issued on a short-term basis and are lifted after a few days, once water clarity improves.

Longer term advisories are generally in effect because a system has inadequate treatment. These advisories usually affect smaller water supply systems. Tables 6 and 7 provide a breakdown of the length of time advisories had been in effect as of November of both 2005 and 2006.

Unfortunately, insufficient information was provided with these data to understand how many of the November 2005 advisories were removed by November 2006, as improvements were made to water supply systems. Similarly, it is unclear how many of these advisories continued on into 2006. For example, at least some of the decrease in the number of advisories in place for five to ten years between 2005 and 2006 is clearly linked to a corresponding increase in the number of advisories in place for more than ten years (as of November 2006). Similarly, the increase in the number of advisories in effect for one to five years in 2006 results from some 2005 advisories in the zero to one year category continuing through November 2006. However, it is not possible to readily determine how many systems in any given category had their boil water advisory or notification lifted, nor how many new advisories were put in place.

In First Nations communities, 24 drinking water advisories were in effect on November 1, 2005, compared to 23 on November 15, 2006. These advisories affected approximately 6 per cent of First Nations water systems on reserve, or an

Click for Table 6 data

Table 6 Boil water advisories in place for specified periods of time (excluding First Nations reserves), as of November 2005

	Vancouver Coastal	Vancouver Island	Interior	Fraser	Northern	Total Advisories
0 – 1 year	10	38	50	6	25	129
>1– 5 years	26	24	111	2	22	185
>5 – 10 years	9	5	44	21	7	86
> 10 years	8	10	62	5	3	88
Total advisories	**53**	**77**	**267**	**34**	**57**	**488**

Click for Table 7 data

Table 7 Boil water advisories in place for specified periods of time (excluding First Nations reserves), as of November 15, 2006

	Vancouver Coastal	Vancouver Island	Interior	Fraser	Northern	Total Advisories
0 – 1 year	6	6	55	9	9	85
>1 – 5 years	28	35	127	6	29	225
>5 – 10 years	4	6	59	5	3	77
> 10 years	13	7	59	7	7	93
Total advisories	**51**	**54**	**300**	**27**	**48**	**480**

Click for Table 8 data

Table 8 Boil water advisories in place for specified periods of time (on First Nations reserves) as of November 2006

	First Nations (on Reserve)
0-1 year	8
>1 – 5 years	10
>5 – 10 years	5
> 10 years	0
Total advisories	**23**

Source: First Nations and Inuit Health, Health Canada

estimated 3,531 people in 2005 and 3,345 people in 2006. Monthly water quality reports were provided to each health authority and shared within Health Canada's First Nations and Inuit Health Branch's Environmental Health Services program and a federal-provincial-First Nations drinking water committee (see Section 3). Notably, none of the advisories in effect on reserve have been in place for more than ten years. This fact reflects a fairly aggressive program to assess and improve water supplies on reserve, as well as a lack of formally recognizing and reporting boil water notices a decade ago.

The challenges associated with data collection and reporting may eventually be resolved through the drinking water information initiative and the BC-Yukon public health information project. To be successful, both of these initiatives require further commitment from government, including funding and other resources. For more information on these initiatives, see Section 3.3 and Recommendation 7.

Interior Health Authority's Position on Turbidity

The water supply industry and regulatory bodies generally accept that most surface water sources require filtration to make them suitable for domestic use. The *Guidelines for Canadian Drinking Water Quality* (see http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index_e.html) recommend filtration for surface sources unless they meet a number of criteria:

1. Overall pathogen inactivation is met using a minimum of two disinfectants:
   - ultraviolet irradiation or ozone to inactivate cysts/oocysts;
   - chlorine (free chlorine) to inactivate viruses; and
   - chlorine or chloramines to maintain a residual in the distribution system.
2. Prior to the point where the disinfectant is applied, the number of *E. coli* bacteria in the source water does not exceed 20/100 mL (or, if *E. coli* data are not available, the number of total coliform bacteria does not exceed 100/100 mL) in at least 90 per cent of the weekly samples from the previous 6 months.
3. Average daily source water turbidity levels measured at equal intervals (at least every 4 hours), immediately prior to where the disinfectant is applied, are around 1.0 NTU but do not exceed 5.0 NTU for more than two days in a 12-month period. Source water turbidity also does not show evidence of protecting microbiological contaminants.
4. A watershed control program (e.g., protected watershed, controlled discharges, etc.) is maintained that minimizes the potential for fecal contamination in the source water.

While data are incomplete, 404 water supply systems in the province are known to filter their surface water sources and 490 are known to use only disinfection (see Section 5.3, Tables 17 and 18). While information is not readily available on the number of water suppliers currently providing unfiltered surface water that meets the recommended criteria, it is well known that a large number do not. Throughout the province, water suppliers are being required to assess their systems, determine the improvements needed, and take steps to make those improvements. In the interim, drinking water officers have been challenged with how to notify the public about the potential risks they may be exposed to when they drink unfiltered surface water. In a large number of cases, the turbidity criteria is not met, especially during periods of snow melt or heavy rainfall. This situation is of particular concern where watersheds have mixed land uses such as farming, cattle grazing, recreation, and residential developments. Each of these activities can introduce pathogens into the watershed, which can then be washed into streams and lakes when snow melts or when there is heavy rainfall.

Drinking water officers expect all water suppliers to be taking steps to meet the turbidity recommendations in the *Guidelines for Canadian Drinking Water Quality*, while recognizing that infrastructure improvements, such as adding filtration (which may be required to protect public health) will take time. Financial planning, engineering assessments, and arranging for contractors and equipment can take several years. As an interim measure, health authorities are working to ensure members of the public are well informed about any health risks they may be exposed to from their drinking water.

The decision about when to issue advisories related to turbidity is generally made on a system-by-system basis. Drinking water officers take into account the sources of turbidity (for instance, clay or silt is less likely to interfere with disinfection than organic matter), the degree to which the watershed is protected from sources of pathogens, and the history of the water system's experience with turbidity.

In 2006, the Interior Health Authority initiated a Turbidity Education and Notification Campaign to provide advice to recipients of unfiltered water when source water turbidities exceed the national

guidelines for unfiltered surface water. The key objective of the campaign is to ensure that people have the information they need to make informed decisions about the quality of their drinking water and whether they need to take added precautions during periods when water quality may be compromised. The program requires some water suppliers to issue a water quality advisory when turbidity levels range between 1 and 5 NTU and to issue a boil water notice when turbidity is at or above 5 NTU. The water quality advisory is general advice that the risk of illness increases as turbidity increases and that some people, particularly the immunocompromised or vulnerable people, such as the elderly, may want to consider taking precautions with their drinking water. Conversely, the boil water notice tells all people that the water is unsafe and that they should boil it prior to consumption or take other precautions, such as drinking bottled water.

Within the Interior Health Authority, 34 of the 83 large water systems rely on unfiltered surface waters. During periods of snow melt or heavy rain, turbidity levels in many of the systems often exceed the recommended maximum levels of 1 and 5 NTU. The health authority's campaign complements similar public notification actions undertaken by water suppliers when they flush water mains during routine maintenance, when public health is threatened by failures in water treatment, when water becomes contaminated in distribution systems, or when there is evidence of waterborne disease in a community.

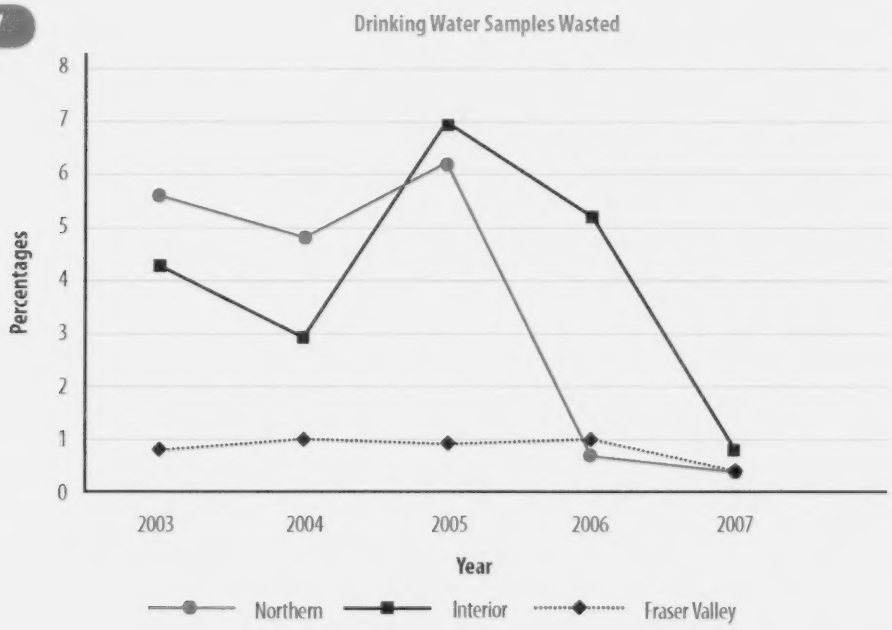
During the 2006 campaign, 20 water suppliers in the region notified the public about turbidity concerns. Fourteen of those suppliers were in the Okanagan.

Some water suppliers and local governments question elements of the program. For some suppliers, the program results in a series of on-and-off advisories as turbidity fluctuates during periods of flooding. In some cases, such as in the Kelowna area, several water suppliers serve a larger community and it is not easy to ensure people served by a particular water supply are getting information relevant to their supply rather than a neighbouring supply. Concerns have been expressed that when there is no evidence of illness in the community, ongoing advisories related to turbidity may make people complacent; as a result, they may not respond to an advisory when there is a waterborne disease outbreak or a significant treatment failure.

Despite these concerns, most affected water suppliers have managed to develop improved communication strategies to get the appropriate information to their customers in a timely manner through dial-out telephone services and the Internet. The Minister of Health has recently sought advice from a technical advisory committee.[8] This advice may allow the Minister to provide guidance to drinking water officers in the 2008/2009 fiscal year.

Click for Figure 7 data

Figure 7



Note: Samples can be wasted if transportation delays mean the samples arrive after the maximum allowable time, if the samples arrive frozen instead of simply chilled, or if there is operator error in filling out forms, etc.

Source: Data from BC Centre for Disease Control Laboratory Services.

[8] *The report of the technical advisory committee is available online at http://www.healthservices.gov.bc.ca/protect/dwcommittee.html.*

Laboratory Testing of Drinking Water Samples

Water samples collected for microbiological sampling are time-sensitive; laboratories must begin to analyse them within 30 hours of collection. In most areas of BC, water samples are tested well within this time limit. However, water suppliers in some remote areas (e.g., in the North, in some central coastal regions and in some parts of the Kootenays) may face obstacles in getting samples to the closest laboratory in a timely manner.

Between 2005 and 2007, significant progress was made regarding the efficient transport of drinking water samples to laboratories. In the Northern Health Authority, for instance, the percentage of wasted drinking water samples sent to BC Centre for Disease Control laboratories dropped from more than 6 per cent in 2005 to less than 1 per cent in 2007, through improved sample transportation and, in the Fort St. John area, the use of a local laboratory (Figure 7). The reasons for wasted samples vary from transportation delays (resulting in samples arriving at the laboratory more than 30 hours after collection) to frozen samples to operator error (such as writing the wrong date on the sample bottle or requisition form). Recently approved laboratories in Grandhaven and Calgary are more accessible to some water suppliers in the Peace River area and the East Kootenays, reducing the number of samples wasted because of transportation delays.

Laboratory Approval and Audits

The laboratories that test drinking water samples for microbiological water quality in BC are approved by the Provincial Health Officer. This process ensures laboratories are using appropriate testing methods, that results are reliable, and that processes to immediately report positive *E. coli* results are in place. The Enhanced Water Quality Assurance Program (EWQA) reviews applications from laboratories and recommends which ones should be approved. EWQA program auditors also visit laboratories to make sure they are meeting the appropriate standards. See Appendix A for the checklist used by auditors when evaluating a laboratory for approval.

In the 2005 calendar year, the EWQA conducted and reviewed twelve laboratory audits, nine of which were for laboratory re-approvals. Three new laboratories were approved. Two new ALS Environmental laboratories filled gaps in service for remote areas: the laboratory in Grandhaven serves northern communities in the Fort St. John area and the laboratory in Calgary serves the Elk Valley, including Fernie, Sparwood, a ski hill, and several mines. In 2006, the EWQA conducted six inspections and reviewed six laboratory audits for re-approval. No new laboratories were approved in 2006. The list of approved laboratories for 2005/2006 and 2006/2007 is shown in Table 9.

Table 9 Laboratories approved by the Provincial Health Officer for water microbiology testing, 2005/2006 and 2006/2007

Lower Mainland	Vancouver Island	Interior
ALS Environmental, Vancouver (Total Coliform, Fecal Coliform, E. coli)	Cantest Ltd., Victoria (Total Coliform, Fecal Coliform, E. coli)	Caro Environmental Services, Kelowna (Total Coliform, Fecal Coliform, E. coli)
BCCDC Environmental Microbiology Laboratory, Vancouver (Total Coliform, Fecal Coliform, E. coli)	CRD Water Laboratory, Victoria (Total Coliform, E. coli)	Eco Tech Laboratory Ltd., Kamloops (Total Coliform, Fecal Coliform, E. coli)
GVRD Water Laboratory,* Burnaby (Total Coliform, E. coli)	MB Laboratories Ltd., Sidney (Total Coliform, Fecal Coliform, E. coli)	North
IG Micromed Environmental Inc., Richmond (Total Coliform, Fecal Coliform, E. coli)	North Island Laboratories, Courtenay (Total Coliform, Fecal Coliform, E.. coli)	ALS Environmental, Grandhaven (Total Coliform, E. coli)
Cantest Ltd., Burnaby (Total Coliform, Fecal Coliform, E. coli)	Mid-Coast	Alberta
Norwest Labs,** Surrey (Total Coliform, Fecal Coliform, E. coli)	Northern Laboratories Ltd., Prince Rupert (Total Coliform, Fecal Coliform, E. coli)	ALS Environmental, Calgary (Total Coliform, E. coli)
Maxxam Analytics Inc., Burnaby (Total Coliform, Fecal Coliform, E. coli)		Provincial Laboratory For Public Health (Microbiology), Calgary (Total Coliform, Fecal Coliform, E. coli)
		Provincial Laboratory For Public Health (Microbiology), Edmonton (Total Coliform, Fecal Coliform, E. coli)

Notes:
*Now Metro Vancouver Water Laboratory.
**Now Bodycote Testing.

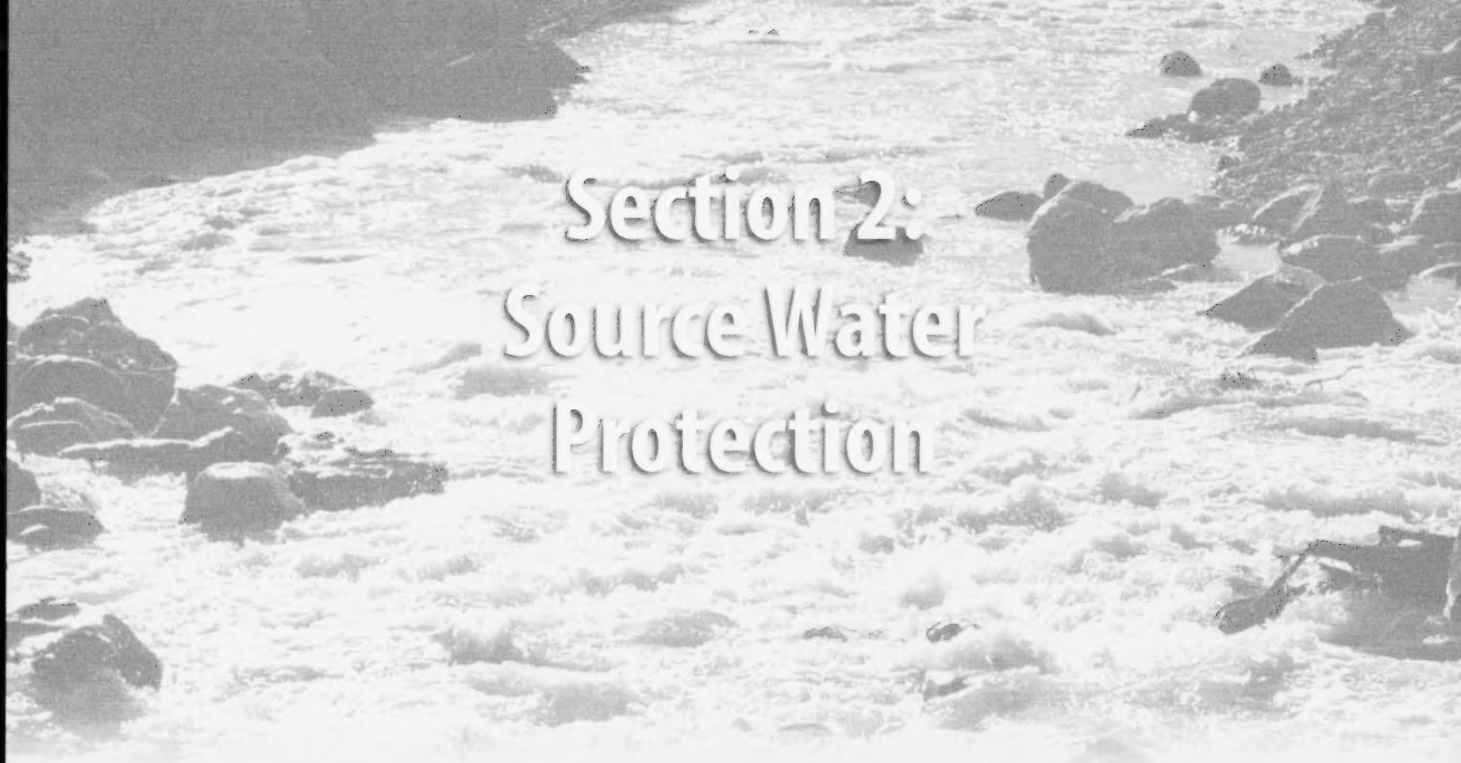
A current list of approved laboratories can be found online at http://www.bccdc.org/downloads/pdf/lab/EWQA.html.

In addition to auditing and recommending laboratories for approval by the Provincial Health Officer, the EWQA was involved in a number of projects during the reporting period. For instance, in 2005 and 2006, it held annual training workshops for auditors. In 2005, the workshop included a written exam for auditors to test their knowledge of the laboratory approval process. All the auditors passed the exam with marks ranging from 82 per cent to 100 per cent.

In 2005, the EWQA conducted an audit review to ensure all laboratories were ready to perform E. coli testing. In both 2005 and 2006, the EWQA was involved in an ongoing project to harmonize the approval and accreditation services of both the EWQA and the Canadian Association for Environmental Analytical Laboratories (CAEAL) for laboratories subscribing to both services.

In 2005, the Quality Assurance Working Group of the EWQA worked on a procedure for evaluating new laboratory methods that could result in reduced costs for testing drinking water samples. In 2006, the EWQA prepared guidelines for evaluating the use of bacteriological media not in the *Standard Methods for the Examination of Water and Wastewater* (21st edition). Such an evaluation would potentially allow the use of media that are approved by reputable agencies but that are not listed in the reference work.

In 2006, the EWQA developed and instituted a new checklist report for its auditors to ensure standardized and consistent reports (see Appendix A). These reports are quicker to prepare than the previous narrative reports. Finally, the organization undertook a review of the frequency of audits to address challenges stemming from not having enough auditors on hand. Over time, fewer audits would reduce inspection costs to approved laboratories.



Section 2: Source Water Protection

Source water protection is an important component of the multi-barrier approach to ensuring safe drinking water. While it is not the ultimate solution for all drinking water problems, source water protection helps maintain source water quality by making sure it is not degraded through industrial, agricultural, or recreational activities, or through land development.

Protecting sources of drinking water is complex and relies on the work of many individuals and organizations, including federal government departments and provincial government ministries and agencies, local governments, political leaders, non-governmental organizations, special interest groups, and the general public.

During the reporting period, changes were made to legislation and regulations that have an impact on source waters. For instance, the Ground Water Protection Regulation came fully into force. The regulation focuses on water quality protection and the sustainable use of groundwater supplies. Part 2, which took effect on November 1, 2005, deals with standards for well construction and closure and the identification of wells. The Ministry of Environment has been implementing the regulation through compliance promotion, registering well drillers and pump installers, compliance audits, enhancing the WELLS database and processing submitted well reports, and by building internal capacity.

Overall, the number of Ministry of Environment staff working directly or indirectly on drinking water issues increased over the reporting period from the equivalent of 25 full-time positions to 28. This workload was undertaken by more people largely through activities related to general water quality protection activities. Various Ministry of Environment programs monitor and assess water quality, including a water quality monitoring network, which monitors raw water quality used as a source for drinking water and aquatic systems. During the reporting period, the Ministry of Environment continued to develop water quality guidelines for specific water quality variables in source water (based on the designated water use) and established water quality objectives to protect the most sensitive water use at a specific location.

Between 2005/2006 and 2006/2007, the Ministry of Environment increased spending on contracts and expenses for water quality initiatives by approximately 24 per cent. Its grants and funding transfers to non-governmental and other organizations to support source water protection efforts increased nearly 40 per cent, from $255,000 to $354,000.

To help water suppliers implement water conservation programs, the Ministry of Environment issued advisories when rivers experienced low streamflows. Further, ministry staff worked with smaller local governments to develop and refine drought management plans and water restriction bylaws. The government worked with the Township of

Langley to make sure its Water Management Plan (the first of its kind in the province) ensures a safe and sustainable supply of groundwater to the community.

Also in the area of water conservation and sustainability, the British Columbia Water & Waste Association, in partnership with the provincial government, continued to develop the Water Sustainability Action Plan. The plan has evolved into a comprehensive program called "Convening for Action." It envisions that water sustainability will be achieved in BC through the implementation of green infrastructure policies, practices, and standards. Initiatives undertaken in the reporting period include the South Okanagan Regional Growth Strategy, the Water Balance Model for British Columbia (http://www.waterbalance.ca) and the Waterbucket.ca website (http://www.waterbucket.ca).

In the area of watershed protection, progress was made towards amending the *Forest and Range Practices Act* to allow the designation of community watersheds and to ensure they are designated in a fair and consistent manner, taking into account public safety and sound resource management.

The Forest and Range Evaluation Program is working to determine whether licensees are meeting government objectives. In the area of water, these objectives deal with streambank erosion, landslides, and livestock concerns. Staff are developing an evaluation procedure for water that is expected to be ready for province-wide application in 2009.

Other government ministries are also involved in protecting source water. During the reporting period, the Ministry of Agriculture and Lands conducted studies about soil nutrients and water, issued advisories and undertook projects related to manure loading, continued to support the Environmental Farm Plan Program and the National Water Supply Expansion Program, and initiated water metering projects.

These initiatives are described in more detail in the pages that follow.

2.1 Effective Strategies

Regulatory Changes

Ground Water Protection Regulation

The Ground Water Protection Regulation (GWPR), pursuant to the *Water Act*, came into full force on November 1, 2005.[9] The regulation focuses on water quality protection and the sustainable use of groundwater supplies. Part 1 of the regulation, which deals with registration requirements for qualified well drillers and qualified pump installers, came into effect in November 2004; Part 2, which deals with standards for well construction and closure, the identification of wells, etc., took effect November 1, 2005. The Ministry of Environment is moving forward to develop Phase 2 of the regulation for consideration by Cabinet. This phase will help contractors take source water protection into account when choosing well locations and may provide standards for well pumps, water analysis, and reporting. The plan for Phase 3 includes regulations for implementing water management plans, well operation, and the protection of groundwater quantity, quality, and use. Details about implementing the regulation can be found in Section 2.2. The parts of the regulation enacted to date are a significant step forward toward meeting Recommendation 2 related to source water protection from the 2007 report, *Progress on the Action Plan for Safe Drinking Water* in British Columbia. The regulation will help ensure wells are protected from direct contamination. Phase 2 will further protect wells from contamination.

Forest and Range Practices Act Amendments

In 2006/2007, the Ministry of Environment drafted a policy document that would allow community watersheds to be designated under the *Forest and Range Practices Act*. The policy document provides direction to agency staff and decision makers on the procedures and guidelines used to designate, amend, or cancel "community watershed" status. The application of these procedures and guidelines will ensure that decisions about community watershed status will be made in a fair and consistent manner and take into account public safety and sound resource management.[10]

[9] *The regulation was promulgated in June 2004.*

[10] *The authority for designating, amending, and cancelling community watersheds under the* Forest and Range Practices Act *and regulations was transferred to the Minister of Environment from the Minister of Agriculture and Lands in December 2007. Pursuant to Section 8(2) of the Government Actions Regulation, the Minister of Environment may also establish water quality objectives for a community watershed.*

Water Sustainability Action Plan for British Columbia

The Water Sustainability Action Plan for British Columbia was developed in 2003/2004 by the BC Water & Waste Association through a partnership with the provincial government. The Water Sustainability Action Plan covers an array of on-the-ground initiatives that advance an approach to community planning and development that puts water considerations at the centre. The Action Plan has since evolved into a comprehensive program called Convening for Action, formally launched in February 2005. The program, delivered through the BC Water & Waste Association, is made up of four areas of activity:

- Products and tools.
- Networking and outreach.
- Capacity building.
- Education and training.

During 2005/2006 and 2006/2007, the initial phases of regional pilot programs were initiated at events in the South Okanagan, in Metro Vancouver, and on Vancouver Island.

The Convening for Action vision is that water sustainability in British Columbia will be achieved by implementing green infrastructure policies, practices, and standards. The goal is to reach out to practitioners whose work involves land and water resources and educate them about practices that better balance the relationships between settlement activity and ecological assets in local and regional landscapes.

During the reporting period, the Convening for Action program provided local governments and practitioners with the tools and experience to better manage land and water resources. Noteworthy accomplishments include:

- Completion of the South Okanagan Regional Growth Strategy (the pilot for water-centric action in British Columbia).
- Holding of the pilot program for the Showcasing Green Infrastructure Innovation Series in Metro Vancouver in 2006. The pilot program's objectives include looking at how water is used and the impacts of water use on the sustainability of a water supply. Hosted by local governments, the success of the pilot program paved the way for similar showcases held elsewhere on the coast in 2007.
- Conversations with an ad hoc Mayors and Chairs Focus Group in 2006, which yielded insights that have shaped the implementation of the Convening for Action program. These insights are documented in a report titled *Water, Choosing Sustainability for Life and Livelihoods: Convening for Action in British Columbia* available at http://www.waterbucket.ca/cfa/index.asp?sid=10&id=61&type=single.

Tools developed under the Water Sustainability Action Plan include the Water Balance Model for British Columbia (at http://www.waterbalance.ca) and the Waterbucket website (at http://www.waterbucket.ca). During 2005/2006, the Waterbucket website expanded from two to eight "communities of interest." For more information, see "Tools" in Section 2.2.

Each fiscal year, the Ministry of Agriculture and Lands has been making improvements to the Water Balance Model. This model can be used by land developers to find out how much water runs off a particular site and how much goes back to ground, in order to better understand how to maintain groundwater supplies. In mid-2006, work started to integrate the Water Balance Model with QUALHYMO, a continuous simulation tool developed in the early 1980s by the Ontario Ministry of Environment for rainfall-runoff modeling. The integrated tool, completed in 2008, will help local governments achieve desired urban stream health and environmental protection outcomes at a watershed scale.

Private Managed Forest Land Council Levies Fine

On January 5, 2006, the Private Managed Forest Land Council received a complaint from a landowner whose property is downstream from a TimberWest Forest Corporation cutblock near Port Alberni.

The Council investigated the situation and, on May 15, 2006, concluded that TimberWest had contravened the *Private Managed Forest Land Act* on Block T141 in the Beaufort Range area. The Council determined that four of the 26 culverts it had inspected had not been installed in a manner that would prevent excavated soil from entering directly into a stream, or that would minimize soil erosion. The Council levied an administrative penalty against the corporation of $7,500 per culvert, for a total penalty of $30,000.

The streams in question are part of the source water supply for the Beaver Creek Improvement District. The District currently only chlorinates its drinking water supply. The water system serves

approximately 3,500 people. In December 2005 and January 2006, the water system issued water quality advisories as a result of high source water turbidity. The issuance of these advisories was alleged to result from TimberWest Forest Corporation activities and to coincide with high rainfall. This allegation was investigated by the Private Managed Forest Land Council (see http://www.pmflc.ca/docs/IN05019-Investigation-Report.pdf). The geography of the watershed was also a factor in the turbidity spikes. In addition to the above allegations, in the two years previous, the water supplier had been asked to deal with turbidity issues in the source water. The supplier has hired an engineering firm to look at treatment options.

The Private Managed Forest Land Council is an independent provincial agency established under the *Private Managed Forest Land Act* to protect key public environmental values on private managed forest land in BC. More information on the Council is available online at http://www.pmflc.ca.

2.2 Aligned Management Systems

Budgets and Resources

In 2005/2006, the equivalent of 25 full-time employees worked for the Ministry of Environment on water issues or activities that directly or indirectly supported the Action Plan for Safe Drinking Water in British Columbia. These staff included surface and groundwater technical specialists, source water protection specialists, policy analysts, monitoring and reporting staff, water technicians, impact assessment biologists, and management. The staff did not include compliance officers or toxic management and emergency response staff who are called out on an as-needed basis. In 2006/2007, the number of staff increased to the equivalent of 28 full-time employees.

In 2005/2006, the Ministry of Environment spent a total of $933,000 on contracts and expenses for protecting, mapping (see http://www.env.gov.bc.ca/wsd/data_searches/wrbc), and characterizing groundwater aquifers; monitoring water quality; and operating a watershed awareness program and regional watershed projects. In 2006/2007, it spent more than $1,160,000 on these activities.

In addition to its own programs, the Ministry of Environment provides grants and funding transfers to non-governmental organizations (NGOs) and other organizations to support source water protection efforts. In 2005/2006, the ministry provided more than $255,000 in grants and transfers to support groundwater protection, watershed awareness, water quality hazard inventories and water management planning initiatives. A further $99,000 was distributed in 2006/2007.

Tools

Online Information Sharing

One of the six elements of the Water Sustainability Action Plan for British Columbia, and its key communications tool, is a website: http://www.waterbucket.ca. The site was launched in 2005/2006 and promotes projects and case studies related to water sustainability and conservation in BC. It brings together local governments, water utilities, water suppliers, and managers to share information, practical tools, and ideas related to "communities of interest" topic areas. Since its inception, the site has been expanded to include communities of interest on "Water Centric Planning" and "Agriculture and Water." Funding for the website comes from a variety of sources. In 2005/2006, the Ministry of Agriculture and Lands provided $15,000 in support.

Best Management Practices

In 2004, the Ministry of Transportation issued a document entitled *Best Management Practices for Highway Maintenance Activities* to help maintenance contractors apply standardized environmental protection measures in their operational work. The document cross-references the various maintenance activities carried out, some of which could impact water quality. During the reporting period, the best management practices were implemented in the field and technical circulars were developed and disseminated. These circulars describe how to protect drinking water at rest stops. Their content will be incorporated into the next version of the best management practices document.

Water Licensing

The provincial government has developed a guide for people who are applying for a water licence. The guide, *Water Applicant's Agency Resource Guide*, describes the responsibilities of the agencies that may be associated with water licensing in particular cases. It was updated in March

2006 and is available, along with other information about water licensing, at http://www.env.gov.bc.ca/wsd/water_rights/licence_application.

Source Water Quality Monitoring and Assessment Programs

A number of Ministry of Environment programs monitor and assess water quality. These programs take into account many considerations, including drinking water source assessments and protection. Information on these programs is available on the Water Stewardship Division website: http://www.env.gov.bc.ca/wsd/plan_protect_sustain.

Water Quality Monitoring Network

The Water Quality Monitoring Network monitors raw water quality for drinking water and aquatic ecosystems. The program is delivered by regional staff from the Ministry of Environment. These staff have sampled about 250 groundwater wells and 135 surface water supplies that are used as drinking water sources. Activities include sample collection, shipping, analysis, and data reporting, as well as some data assessments which will help support the development of water quality objectives.

Water Quality Guidelines

BC Water Quality Guidelines were developed by the Science and Information Branch of the Ministry of Environment. The guidelines are science-based numerical concentration limits or narrative statements that set out acceptable ranges for specific water quality variables (such as arsenic) in source waters, based on the designated water use (such as drinking water or aquatic life). British Columbia has established Water Quality Guidelines for 42 substances.

Water Quality Assessments and Objectives

The Ministry of Environment also establishes Water Quality Objectives for a range of water quality parameters in specific water bodies (such as individual community watersheds) based on monitoring results. Water Quality Objectives are derived from Water Quality Guidelines and are set to protect the most sensitive designated water use at a specific location, taking local circumstances into account. There are more than 50 approved Water Quality Objectives reports covering more than 150 water bodies in BC. The Ministry has approved Water Quality Guidelines for one community watershed (McKelvie Creek on Vancouver Island) and has Water Quality Objectives in various stages of completion for approximately 40 other community watersheds across the province.

Agriculture and Source Water Protection Programs

The Ministry of Agriculture and Lands is involved with a number of linked programs and initiatives that deal with source water protection and conservation, including studies about soil nutrients, advisories and projects related to manure loading, the Environmental Farm Plan Program, the National Water Supply Expansion Program, and water metering.

Soil Nutrients

In 2005, the Ministry of Agriculture and Lands initiated a Fraser Valley Soil Nutrient Study.[11] This study was completed and findings released in 2006/2007. In general, the study found high levels of some nutrients such as nitrate-nitrogen and phosphorus in tested soils. High levels of nutrients in soil can run into water bodies or leach into aquifers, impacting source water quality. Follow-up recommendations to the study are being developed and include the need to conduct further field studies to better understand the actual links between nutrients in soil and the quality of surface water and groundwater. In 2006/2007, the Ministry of Agriculture and Lands started planning an Okanagan Nutrient Management Study.

Manure Loading

In both 2005/2006 and 2006/2007, advisories were issued to farmers telling them when it was appropriate to apply manure to their fields to ensure manure was applied in a manner that fertilizes crops but protects water quality. For instance, applying manure after spring run-off means the fertilizer is more likely to stay in the soil and not get washed into waterways. In 2005/2006, manure storage enhancement projects were initiated through the Agriculture Environment Initiative. In 2006/2007, the Ministry of Agriculture and Lands initiated a study to assess farm manure storage capacity in the Fraser Valley. Storage issues are important for drinking water because if nutrients are added to the soil at times when crops will not use them as fertilizer, they can eventually seep into groundwater. Since the cattle cannot be moved, the study is

[11] *The study is available at http://www.agf.gov.bc.ca/resmgmt/EnviroFarmPlanning.*

looking at better ways to store and use the manure (such as harnessing "green" energy from it).

Environmental Farm Plan Program

The Environmental Farm Plan Program is a voluntary program, funded by the federal and provincial governments, that provides financial incentives to agricultural producers who enhance the environmental performance of their farms. Between 2003, when the program started in BC, and March 2006, the Ministry of Agriculture and Lands trained planning advisors and developed and distributed resource materials. Sixteen farm organizations deliver the program to farmers. During this time period, the farm organizations held 578 small group workshops with 2,819 farm producers on how to complete an environmental farm plan and issued 783 statements of completion. These numbers rose in the 2006/2007 fiscal year, with an additional 647 workshops (for a total of 1,225) and 1,098 participants (bringing the total number of participants to 3,917). By the end of 2006/2007, 1,565 statements of completion had been issued. A key component of environmental farm plans is the development of beneficial management practices. Approximately 30 per cent of beneficial management practices funded under the Environmental Farm Plan Program address water quality concerns.

By March 2006, 597 applications for farm improvements had been approved with $3.275 million in program funding. Farm producers spent more than $11 million for improvements. By March 2007, an additional 857 applications were approved with $4.425 million in funding. Producer expenditures rose by $15 million to a total of $26 million over the reporting period.

Because most farms pump irrigation water from their own water sources, the program touches on issues related to water use and nutrients. A calculator has been developed that planners can use to help farmers figure out when to water and how much, given soil conditions and current climate data. The climate data is provided by a network of Farmwest weather stations. The calculator is available through Farmwest at http://www.farmwest.com. Workshops about the weather stations and the calculator have been delivered by organizations such as the Fraser Basin Council.

While the completion of more than 1,500 environmental farm plans shows substantial progress, nearly 20,000 farms are recognized in the province. Further work is clearly required.

National Water Supply Expansion Program

The National Water Supply Expansion Program, delivered through the Ministry of Agriculture and Lands, builds watering facilities for cattle to keep them from drinking water directly from streams. The program also creates new dugouts and wells. These projects reduce the likelihood that cattle will contaminate streams with their feces and reduces erosion by preventing them from damaging stream banks. In 2005/2006, 413 applications from farms were reviewed, 322 were approved, and 131 projects were completed at a cost of $872,676. In 2006/2007, 590 applications were reviewed, 415 were approved, and 214 projects were completed at a program cost of $1,113,000.

One obstacle faced by ranchers in developing off-site watering facilities is the inability of these ranchers to obtain water licences where streams have already reached their maximum allocation to other water users. In these cases, ranchers have little choice but to simply allow their cattle direct access to the stream.

Irrigation and Water Metering

The Ministry of Agriculture and Lands held five workshops on irrigation practices in 2005/2006 and four in 2006/2007. It initiated four water metering projects in 2005/2006 and one in 2006/2007. It added twelve climate stations to Farmwest (for a total of 88) in 2005/2006 and eight (for a total of 96) in 2006/2007.

Ground Water Protection Regulation Implementation

Starting in 2005, the Ministry of Environment has been implementing the Ground Water Protection Regulation through:

- Compliance promotion.
- Registration of well drillers and well pump installers.
- Compliance audits.
- Enhancement of the WELLS database and processing submitted well reports.
- Building internal capacity.

Compliance Promotion

In 2005/2006 and 2006/2007, staff made 49 presentations about the Ground Water Protection Regulation to various stakeholder groups and at local community meetings. The Ministry of Environment's Water Stewardship Division also submitted regular articles to the British Columbia Ground Water Association's quarterly newsletter and one to the Association of Professional Engineers and Geoscientists of BC journal Innovation. Staff also made presentations at an international conference in Ottawa.

Registration of Well Drillers and Well Pump Installers

As of November 1, 2006, 273 drillers and 273 pump installers were registered with the Ministry of Environment. Eighty-four per cent of the drillers and 86 per cent of the pump installers were registered through the Regulation's grandparenting provision; the remaining drillers and pump installers were registered on the basis of holding a certificate recognized by the Regulation. The Ministry of Environment continues to raise awareness about the need for drillers and pump installers to be registered in order to do any well pump installation work. A list of qualified well drillers and pump installers is available to the public through the Ministry of Environment website: http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells.html#reg.

Compliance Audits

In 2006/2007, staff conducted 18 on-site well drilling inspections and responded to more than 90 complaints. Water Stewardship Division staff also inspected 61 public water systems, often in partnership with public health inspectors or drinking water officers from the regional health authorities.

Enhancement of the WELLS Database and Submission of Well Reports

In 2006/2007, the Water Stewardship Division received well identification information for 747 public water supply system wells and entered the data into the Ministry of Environment's WELLS database. The Division also received 53 well closure reports.

During the same time period, the Water Stewardship Division received more than 5,000 well construction reports from drillers and processed more than 900 of them into WELLS. The reports provide valuable information on local groundwater resources and allow staff to better assess and identify issues related to compliance to well construction standards.

The Division also partnered with the BC Ground Water Association to develop and deliver technical workshops for drillers.

Building Internal Capacity

Since 2005, the Ministry of Environment has led a Ground Water Regulatory Implementation Team to oversee the implementation of the Ground Water Protection Regulation. The Team has undertaken annual compliance activities and the development of a policy and procedures manual.

A major workshop was held in October 2005 in Kamloops for drinking water officers, public health inspectors from all the regional health authorities, and Water Stewardship Division groundwater staff. Discussions included the implementation of Phase 1 of the Ground Water Protection Regulation to identify opportunities for collaboration on drinking water issues related to wells. This workshop has resulted in greater collaboration between the regional health authorities and Water Stewardship Division staff when:

- Conducting inspections.
- Inventorying public water supply system wells.
- Providing technical groundwater advice to regional health authority staff.

Drought Management

The Ministry of Environment helped smaller local governments develop and refine their drought management plans and water restriction bylaws. It also provided broader support for considering drought when developing regional growth strategies in areas like the Okanagan.

The River Forecast Centre monitors and analyses run-off conditions in the province throughout the year. It publishes monthly information bulletins. When drier than normal conditions materialize, these information bulletins are distributed to water purveyors, local industry and stewardship groups in impacted geographic regions. In the summer of 2006, three regionally specific information bulletins were published.

Tofino

In the summer of 2006, the town of Tofino on Vancouver Island experienced drought conditions, which led to severe water restrictions.

The town's water supply comes from a reservoir recharged by the rain. The area receives nearly three metres of rainwater annually, generally receiving enough summer rain to maintain normal water use. Peak water demand during tourist season, when the town's population can swell from 1,700 to nearly 20,000 people, had been a concern for several years and the town had been exploring options for increasing the available water supply.

The summer of 2006 was exceptionally dry, with only 5.8 mm of rain recorded for the month of August, compared to 51.8 mm in August 2005. By late August, it became clear that the town was running out of water. Even the most comprehensive water restrictions were not conserving enough. A backup water supply was brought online to augment the town's normal water supply, but concerns about water quality meant that the town was on a short-term boil water advisory. On August 29, the mayor ordered all lodging and food service businesses to close by September 1. In response, a Victoria businessman with investments in Tofino stepped in with $50,000 to pay for water to be trucked into Tofino; this donation allowed businesses to stay open, but only with strict water conservation measures in place. Fines were set for washing wet suits with municipal water ($100) and for washing cars or watering gardens ($300). Hotels limited towel replacements to reduce laundry, restaurants used paper plates to limit washing, and portable toilets were set up for public use.

Also in late August, Ministry of Environment staff identified water conservation options, worked with district staff on a response plan, oversaw monitoring of the creeks used for the water supply, and provided recommendations for improving monitoring of the water supply.

The rains started up again in September, bringing relief to local businesses, residents, and tourists.

There has been much debate about how the water levels in Tofino could have gotten so low without more warning and whether the town could have acted sooner to improve its water storage capacity, reduce water use, and respond in a more coordinated manner. The lack of rainfall was certainly a factor, but other steps could have been taken to avert the crisis. Additional contributing factors include the fact that Tofino had:

- Inadequate storage capacity.
- Inadequate monitoring of the amount of water in its reservoir and stream flow levels in its source.
- Only partial water metering, and therefore only a limited ability to monitor the water supply.
- Differences of opinion among elected officials about overall water management, which delayed infrastructure improvements.
- Gaps in the town's issues management and communication strategy.
- Gaps in the water supply emergency response and contingency plan.

The water shortage in Tofino had a significant impact on local businesses that rely heavily on tourism. The threat of business closures resulted in cancellations of hotel and resort bookings for the labour day weekend, one of the busiest weekends of the year. The story attracted international media attention, which had the potential to further impact future tourism opportunities by creating uncertainty about the security of Tofino's water supply and the ability of local businesses to meet their commitments to customers.

The fact that drought can impact a water supplier located in a temperate rainforest highlights the need for all water suppliers to prepare for water shortages for both the short- and long-term.

In the time since the crisis, the Town of Tofino has reviewed what happened and what could have been improved. It has since updated its emergency response and contingency plan and, with funding assistance from the BC Community Water Improvement Program, has increased the available water supply.

Water Management Plans

The Township of Langley is developing the first *Water Management Plan* in the province under Part 4 of the *Water Act*. The plan incorporates source protection into ground water management. The plan can become legally enforceable.

The Township is collaborating with the Province of British Columbia to make sure its plan ensures a safe and sustainable supply of groundwater for the community. Groundwater is a vital source of drinking water for Township residents and is the primary source of water for industrial, commercial, and agricultural operations in the Township. The plan is intended to address decreasing ground water levels stemming from rapid growth in population and in industrial and commercial activities, as well as increased water quality risks from poor land management practices. Further information about the water management plan is available at http://www.tol.bc.ca/index.php?option=com_content&task=view&id=1078&Itemid=916.

Liquid Waste Management Plans

Liquid waste management plans are initiated by local governments for liquid waste and land use planning, and are approved by the Minister of Environment. These plans require storm water and water supply issues to be considered by developers. In 2005 and 2007, in response to considerable development pressure along the lake shore, the Columbia Shuswap Regional District initiated Liquid Waste Management Plans that will encompass the entire shoreline of Shuswap Lake. These plans will manage development and protect the water quality of the lake as a source of drinking water, a significant fisheries resource, and as a centre for recreation.

Living Rivers Trust Fund

The Living Rivers Trust Fund was established to support the restoration of streams and rivers in BC damaged by past land-based activities and natural events. The province tripled the value of the trust fund to $21 million in May 2006. Many of the projects undertaken under the Living Rivers Trust Fund benefit drinking water quality. For example, the Stolts Bluff restoration work on the Cowichan River helped stabilize a natural landslide area, reducing downstream siltation problems for fish habitat and turbidity in drinking water. Information on the Living Rivers Trust Fund is available at http://www.env.gov.bc.ca/pac/livingrivers.htm.

BC Parks Compliance with the *Drinking Water Protection Act*

BC Parks has more than 300 water supply systems that either have been or are being brought into compliance with the *Drinking Water Protection Act*. In 2005/2006, all systems were classified by the Environmental Operators Certification Program. In 2006/2007, BC Parks' top priority was the replacement and upgrade of its water systems. Water system assessments are ongoing using a risk management approach to ensure that critical systems are given priority. Parks regions are completing inventories of groundwater sources, and well tagging. Park facility operators are in the process of meeting training and certification requirements for operators. Baseline water quality information for all park water supply systems is being collected and provided to health authorities.

2.3 Performance Measurement and Reporting

Forest and Range Evaluation Program

The Forest and Range Evaluation Program is designed to assess the effectiveness of the *Forest and Range Practices Act* in meeting the provincial government's objectives for each of the forest and range values under the Act. Water is one of the eleven resource values. *The Forest and Range Practices Act* is largely outcome-based, with licensees being required to meet government objectives through best practices, though those practices are not themselves prescribed in law. To determine whether licensees are, in fact, meeting those objectives, the Forest and Range Evaluation Program is developing "effectiveness evaluations", which use selected indicators or attributes of a particular resource value to determine the effects of forest management on the value. The effectiveness evaluation for water will evaluate parameters such as stream bank erosion, landslides and livestock concerns. More information on the *Forest and Range Practices Act* and the use of water indicators can be found online at http://www.for.gov.bc.ca/hfp/frep/values/water.htm.

The evaluation program is ongoing and expanding. In 2005/2006, the development and implementation of four evaluation procedures cost approximately $400,000. By the end of 2006/2007, two evaluation procedures (riparian and biodiversity) had been developed and are mandatory in all forest districts. Three other procedures (water quality, soils, and cultural heritage) are currently under development and are expected to be mandatory in all forest districts within the next two years. Development of the water quality effectiveness evaluation procedure began in 2005 and is expected to be ready for provincial application in 2009.

Forest Stewardship Plans

A workshop was held in March 2007 for government and industry personnel who have completed a Forest Stewardship Plan. The workshop focused on sharing experiences, successes and challenges faced in implementing these plans. The challenges will be addressed through *Forest and Range Practices Act* implementation teams. Copies of the workshop presentations, products, and report can be found at: http://www.for.gov.bc.ca/hth/timten/FRPA_implementation.

Low Streamflow Advisories

The Ministry of Environment issues advisories through its River Forecast Centre when rivers experience low streamflows. The advisories are in newsletter format and provide context for the advisory and information on a range of related subjects including how low flows can impact drinking water. These advisories help water suppliers implement their water conservation programs in a timely and effective manner. These advisories (from June 2005 forward), along with snow survey bulletins and information about groundwater supplies, are posted on the Ministry's website at: http://www.env.gov.bc.ca/rfc.

Provincial Government Performance

Each government ministry publishes an annual service plan report, which details progress on its goals, objectives, strategies, and performance results. The reports also provide information on resources spent in each program area and the number of full-time equivalent employees, as well as capital expenditures in the ministry. The reports are posted on each ministry's website.

The Ministry of Environment's Goal 1 is "Clean and safe water, land and air", with the objective of "enhanced protection and stewardship of our water resources." The performance measure is the percentage of water bodies monitored under the Canada–British Columbia Water Quality Monitoring Agreement that have stable or improving water quality trends. The percentage in 2005/2006 and 2006/2007 that meet the performance measure has remained at 96 per cent, which is on track to meet the target of 96 per cent or greater by 2015/2016. Surface water quality is measured using environmentally significant variables such as temperature, pH, and the presence of nutrients and metals. Thirty water bodies are measured under the agreement. Twelve new monitoring stations have been set up in the past three years but water quality trends will not be available for comparison until data have been collected for five years (after the 2009/2010 fiscal year). The data collected give a good indication of how well water protection and stewardship activities are working, help inform water use authorizations, and help establish further water monitoring requirements. Information on the program is available at http://scitech.pyr.ec.gc.ca/ClimHydro/wq_explanation_e.asp.

The Ministry of Agriculture and Lands Annual Service Plan Report also recognizes the importance of protecting water quality. For instance, the 2006/2007 report's Goal 2 strives for "agriculture and food systems that are environmentally sustainable and promote human, plant and animal health." Key strategies include promoting the development and use of environmental farm plans. In 2006/2007, the target was for 800 farms to have developed such plans. This target was exceeded, with a total of 1,565 farms having developed plans. The Ministry also has a second strategy of contributing "to provincial environmental objectives such as clean air, water and invasive plans [sic]."

Geothermal Wells

It is becoming increasingly popular to heat buildings using a heat exchanger. These devices generally capture the heat from groundwater, but some developments are now using heat from municipal water supply pipes. After heat is taken from the water source, the water is returned to the ground, in the case of geothermal wells, or to city pipes.

Existing legislation is not well designed to regulate these sources of heat from the perspective of protecting water quality. Regulators are concerned that the fluids used in the heat exchangers—which can be food-grade material but could also be toxic compounds such as ethylene glycol, used as an automotive coolant—could accidentally be introduced either into the groundwater, where it could pose a risk to other well water users, or directly to the city water supply.

For systems using municipal water, it is unclear whether users of the cooled water returned to water mains would have to expend more energy to heat their water. A final concern is the potential for these systems to pose a security risk by facilitating the deliberate contamination of the municipal water system by vandals or terrorists. A more detailed discussion of geothermal wells and other heat exchangers will be presented in the next Provincial Health Officer report on *Progress on the Action Plan for Safe Drinking Water in British Columbia*.

Section 3: Integration

The delivery of safe drinking water is a complex process involving many partners. It requires the cooperation and dedication of water suppliers, local governments, health authorities, federal and provincial government agencies and ministries, First Nations, and the general public. Everyone has a role to play.

In 2005/2006 and 2006/2007, the provincial government moved forward on initiatives to improve communication and coordination on drinking water issues and projects across sectors. A number of committees oversaw this work, including the Assistant Deputy Ministers' Committee on Water, the Directors' Inter-Agency Committee on Drinking Water, the Drinking Water Leadership Council, the Multi-Jurisdictional Committee on Water and Wastewater Issues and First Nations, and Federal-Provincial-Territorial coordinating committees (the Federal-Provincial-Territorial Committee on Drinking Water and the Federal-Provincial-Territorial Committee on Health and Environment).

Highlights of their accomplishments include:

- Development of a new Memorandum of Understanding (MOU) on Inter-Agency Accountability and Coordination on Drinking Water Protection, which describes the responsibilities and accountabilities of the Office of the Provincial Health Officer, the regional health authorities, and the various government ministries responsible for all aspects of drinking water protection.
- Development of a Water Action Plan for BC. The provincial government has made a high-level commitment to "Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none." To meet this goal with respect to water quality, the Ministry of Environment has taken a lead role in developing a cross-government strategy to address all water quality issues in a coordinated manner. While much was done to develop an overarching water action plan during the reporting period, a final plan was not approved by Cabinet until 2008.[12]
- Completion of regulatory amendments (Drinking Water Protection Regulation and *Escheat Act*).
- Update of the 1988 Inter-Agency MOU on the Sale of Crown Lands.
- Completion and update of the *Drinking Water Officers' Guide*.
- Update of the 2000 Letter of Understanding Between the Interior Health Authority and Health Canada Regarding the Delivery of Environmental Health/Health Protection Services on Indian Reserves Within the Interior Health Authority.

[12] Living Water Smart *received Cabinet approval in 2008 and is available online at http://www.livingwatersmart.ca/message.html.*

In First Nations communities, Health Canada's community-based Drinking Water Safety Program monitors and ensures the safety of drinking water supplies. To develop First Nations capacity in this area during the reporting period, Health Canada's Environmental Health Services' program created reference documents and held workshops in Kamloops, Nanaimo, and Terrace. In addition to First Nations community members, the workshops included drinking water officers from the health authorities and representatives from Indian and Northern Affairs Canada and the BC Water & Waste Association.

During the reporting period, incremental progress was made towards a drinking water information management solution that would allow water suppliers, health authorities, government agencies, and land users to pool their data and benefit from access to more comprehensive information. Strong commitment from government is needed to see this major project to completion.

The following pages provide details on the aforementioned groups and initiatives and how programs, policies, and information are being integrated across ministries and with those from other organizations.

3.1 Effective Strategies

Memoranda and Letters of Understanding

Memorandum of Understanding on Inter-Agency Accountability and Coordination on Drinking Water Protection

Given that the protection of public health as it relates to drinking water requires a multi-faceted and multi-agency approach, this memorandum of understanding (MOU) was developed to describe the responsibilities related to drinking water protection of various ministries (Agriculture and Lands; Energy, Mines and Petroleum Resources; Environment; Community Services; Health; Forests, Range and Housing; Transportation), the Office of the Provincial Health Officer, and the five regional health authorities. The MOU also describes the accountability of each agency for coordinating source protection, land-use planning, and infrastructure.

The MOU mandates that regional drinking water teams be established by October 2007. As of March 31, 2007, no such teams had been established. However, the Vancouver Island Health Authority had formed a Vancouver Island Watershed Protection Steering Committee that could be used as a model for regional teams.[13] Discussions were underway in Northern Health Authority, Vancouver Coastal Health Authority, Fraser Health Authority, and Interior Health Authority to find potential linkages with the inter-agency management committees described in Section 3.2.

The MOU also includes a commitment to establish regional protocols and to include drinking water coordination activities within each ministry and agency.[14] For instance, hydrologists with the Ministry of Forests and Range may establish protocols with drinking water officers to refine referral procedures to bring water quality concerns with proposed forestry activity to the attention of drinking water officers. The MOU also outlines processes for review and performance management and for dealing with disagreements or unresolved issues. Finally, it includes reporting and other communication requirements.

The MOU received final sign-off in January 2007. It can be accessed through the Ministry of Health website at http://www.health.gov.bc.ca/protect/pdf/drinking_water_protection.pdf.

Inter-Agency Memorandum of Understanding on the Sale of Crown Lands

In the spring of 2006, the Ministry of Health initiated a review and reassessment of the "1988 MOU between the Ministry Responsible for Health and the Ministry Responsible for Crown Lands." The purpose of the original MOU was to ensure health authorities received referrals upon the sale of Crown land to ensure the protection of public health. The MOU allowed local medical health officers and their staff

[13] *The Vancouver Island Watershed Protection Steering Committee changed its name to the Vancouver Island Regional Drinking Water Team in October 2007. It has representatives from all the Regional Districts on Vancouver Island and the provincial government ministries involved in drinking water issues. Two regional watershed protection committees have been formed in the Capital Regional District and in the Regional District of Nanaimo.*

[14] *Draft regional protocols were developed in all five regional health authorities by October 2007.*

to provide advice in situations where a proposed land use could either contaminate drinking water sources or involve the development of new water supplies or sewage disposal systems.

In 2006/2007, a working group formed and drafted terms of reference for updating the MOU. The intent behind updating the MOU is to preserve its original objectives while modernizing the language to reflect the shift from prescriptive legislation to government's principles and objectives for Crown land management. These principles and objectives include the protection of the health and safety of British Columbians. The updated MOU will provide a protocol for cooperation between ministries and coordination of policies and procedures.

Letter of Understanding Between the Interior Health Authority and Health Canada Regarding the Delivery of Environmental Health/Health Protection Services on Indian Reserves Within the Interior Health Authority
This letter of understanding, originally signed in September 2000, was revised and updated in January 2006. Its purpose is to facilitate the delivery of environmental health and health protection services on First Nations lands within the Interior Health Authority, regardless of the status of the people occupying the lands, and to avoid duplication of services. The letter describes the agreed-upon roles and responsibilities of both Health Canada and the Interior Health Authority in the areas of communicable disease control, water supplies, and sewage disposal, among others. Under the letter of understanding, staff with Health Canada's First Nations and Inuit Health Branch coordinate public health programs with Interior Health Authority staff. For instance, they share information about the incidence of enteric illness and coordinate disease outbreak investigations.

3.2 Aligned Management Systems

Inter-Agency Management Committees

Assistant Deputy Ministers' Coordinating Committee on Drinking Water/Assistant Deputy Ministers' Committee on Water
In 2005/2006, the Assistant Deputy Ministers' (ADMs') Coordinating Committee on Drinking Water met three times. Discussions focused on the drinking water information management project and the development of the MOU on Inter-Agency Accountability and Coordination on Drinking Water Protection (see Section 3.1).

In 2006/2007, the committee was restructured, becoming the ADMs' Committee on Water. It was given an expanded mandate to address broader water issues in the province, including, but not limited to, drinking water. The committee is chaired by the Ministry of Environment's Water Stewardship Division. Membership includes those ministries formerly represented on the ADMs' Coordinating Committee on Drinking Water, as well as representatives from the Ministry of Aboriginal Relations and Reconciliation and the Provincial Emergency Program. Its mandate is to ensure an integrated approach to defining, developing, implementing and evaluating water policies, plans, and programs across government, and to oversee the development and implementation of a Water Action Plan for BC.

The committee met five times during the fiscal year. Its work focused on finalizing the MOU on Inter-Agency Accountability and Coordination on Drinking Water Protection, overseeing the development of a Water Action Plan for British Columbia, and addressing issues around source water protection in community watersheds. The MOU was finalized in January 2007. Information about the Action Plan is available at http://www.livingwatersmart.ca. Further progress is needed in the area of source water protection. Summaries of the committee meetings are not currently available on the Internet but are expected to be posted in the near future.

Directors' Inter-Agency Committee on Drinking Water
This committee is made up of representatives from seven ministries and the Office of the Provincial Health Officer. It reports to the ADMs' Committee on Water and is led by the Ministry of Health. During the reporting period, the

committee served as a forum for cross-ministry discussion and coordination of a number of issues and initiatives, including:

- Amendments to the Drinking Water Protection Regulation to address challenges related to small water supply systems.
- Amendments to the *Escheat Act* to resolve problems that result when water utilities escheat to the Crown (see Section 5.1).
- The development of the MOU on Inter-Agency Accountability and Coordination on Drinking Water Protection.
- Implications for water sources resulting from the loss of pine forests to mountain pine beetle infestations.
- Cross-governmental referral procedures when Crown lands are sold.
- Source water protection concerns related to logging and mineral exploration.
- Water supply management and water quality concerns associated with the creation of new subdivisions.

Minutes from this committee's meetings are not available online.

Late in the 2006/2007 reporting period, the Directors' Inter-Agency Committee formed a Small Water Systems Working Group to develop a provincial strategy for small water systems. The working group is to deliver recommendations to the ADMs' Committee on Water on actions that the government should undertake to address elements of provincial legislation that lead to the creation of small water supply systems and that stand in the way of amalgamating or otherwise improving the capacity of existing small water supply systems.[15] For more information on small water systems, see Section 7.

Drinking Water Leadership Council

The Drinking Water Leadership Council met monthly throughout the reporting period, alternating between conference calls and face-to-face meetings. The Ministry of Health is the council's secretariat. During the reporting period, the council undertook a number of activities to ensure consistency between health authorities. The council's primary projects included:

- Completion of, and amendments to, the *Drinking Water Officers' Guide*.
- Provision of advice to the Ministry of Health regarding amendments to the Drinking Water Protection Regulation.
- Training for health authority staff involved in regional drinking water programs.

The council also engaged in discussions to ensure that all health authorities were aware of program issues across the province and how particular situations were being addressed at the local level. These discussions allowed the health authorities to vet their program delivery challenges with staff from the other health authorities, promoting consistent practices and allowing each health authority to benefit from experiences gained elsewhere. Key issues of administrative law were incorporated into the *Drinking Water Officers' Guide*. Technical and scientific issues that influence program delivery are also being considered and may result in common technical protocols being adopted.

During the reporting period, the council was involved in:

- Refining procedures related to the application of the *Drinking Water Protection Act* to mobile work camps.
- Developing the Memorandum of Understanding on Inter-Agency Accountability and Coordination on Drinking Water Protection.
- Developing approaches to approving the use of point-of-use and point-of-entry treatment devices to satisfy the treatment criteria laid out in the Drinking Water Protection Regulation.
- Developing Thompson Rivers University's WaterSafe course.

Additionally, council members reviewed and commented on documents prepared by other organizations such as the Ministry of Environment, the Directors' Inter-Agency Committee on Drinking Water, BC Hydro, and the Federal-Provincial-Territorial Committee on Drinking Water.

Minutes of this committee's meetings are not available online.

[15] *Recommendations are expected at the end of the 2007/2008 fiscal year.*

Multi-Jurisdictional Committee on Water and Wastewater Issues and First Nations

This committee meets once or twice per year at the call of the Chair (Indian and Northern Affairs Canada). The committee includes members from the Ministry of Health, Indian and Northern Affairs Canada, Health Canada, Environment Canada, and the First Nations Summit. Rather than being a working committee, the committee is a forum for discussing and exchanging information about federal and provincial programs, initiatives, and policies related to water on First Nations reserves in BC.

Federal-Provincial-Territorial Coordinating Bodies

The Ministry of Health is actively involved in a number of national committees that coordinate drinking water activities across the country. These committees include the Federal-Provincial-Territorial Committee on Health and the Environment (CHE) and the Federal-Provincial-Territorial Committee on Drinking Water (CDW). These committees establish the *Guidelines for Canadian Drinking Water Quality*, published by Health Canada. During the reporting period, the CHE and CDW approved new and revised guidelines for bacteriological parameters (E. coli, total coliforms, heterotrophic plate count bacteria, and emerging pathogens), arsenic, bromodichloromethane (BDCM), methyl tertiary-butyl ether (MTBE), trichloroethylene (TCE), and total trihalomethanes (THMs). The CDW worked on a number of other guidelines, including benzene; carbon tetrachloride; chloral hydrate; chlorine; chlorite, chlorate, and chlorine dioxide; corrosion control; total haloacetic acids (HAAs); 2-methyl-4-chlorophenoxyacetic acid (MCPA); potassium; and radiological characteristics.

In addition to developing guidelines for drinking water parameters, the CDW worked on the following projects during the reporting period:

- Guidelines for food safety during adverse water conditions (for food processors).
- An indicator tool for source water quality.
- A protocol for addressing short-term exceedances of drinking water guidelines.
- A guidance document on developing a hierarchy for numerical guideline values.
- Work on unregulated small and individual water supplies (including a manual for homeowners).

The CDW also sponsors a national drinking water conference every two years, which brings together experts to share the latest research and activities related to drinking water quality and management. For information about this committee and its work, see the Health Canada website at http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/index-eng.php.

Drinking Water in First Nations Communities

The Drinking Water Safety Program, part of Health Canada's First Nations and Inuit Health Branch's Environmental Health Services program, is a community-based program that works with First Nations to monitor and ensure the safety of drinking water.

Through the program, First Nations are actively involved in monitoring and analysing their public water supplies, as well as raising awareness of water issues in their communities. The program seeks to develop First Nations capacity to prevent and manage the risks of drinking water contamination.

In 2006/2007, the Environmental Health Services program created a number of reference documents to support the Drinking Water Safety Program:

- A procedural manual for safe drinking water in First Nations communities.
- Procedures to address potential waterborne threats to human health in First Nations communities.
- A "Water is a Treasure" activity book for schools.

In addition, workshops were held at a number of locations throughout the province, including Kamloops, Nanaimo, and Terrace. Content focused on the multi-barrier approach to water safety, emergency planning, and community water teams. In each workshop, drinking water officers from the health authorities, Indian and Northern Affairs Canada, and the BC Water & Waste Association played an active role in discussions.

Source Water Protection Activities

Source water protection requires considerable integration and coordination between provincial, federal, and local governments, as well as industry and recreation groups and other stakeholders. Details are provided in Section 2.

3.3 Performance Measurement and Reporting

Websites

In 2005/2006, the Ministry of Health's web page dedicated to Environmental Health, and drinking water in particular, was amended and expanded. The web address is http://www.healthservices.gov.bc.ca/protect/dw_index.html. The changes provide more information on drinking water management and specific links and information for small water systems. In 2006/2007, further additions were made, including information on land use.

Additional key websites with extensive information on water are the Waterbucket site at http://www.waterbucket.ca and the Sustainable Infrastructure Society site at http://www.sustainis.org. Each of these sites provides links to more online resources.

Drinking Water Information Management Project/Drinking Water Information Initiative

The drinking water information management project was initiated in 2003 by the Ministry of Health. It was based on the need to collect and report on data about drinking water systems in the province. It recognized that data management systems used by the health authorities and government ministries addressed specific needs but that broader data collection and sharing was a challenge. The project's objectives were to improve the ability to access and analyse data about drinking water in BC, to provide partners and stakeholders with relevant information in a timely manner to assist with decision-making and reporting, and to support the implementation of the *Drinking Water Protection Act*.

By September 2005, a business analysis was completed with three stakeholder groups: health authorities, partner ministries, and the Office of the Provincial Health Officer. The business analysis exercise identified and analysed drinking water-related responsibilities and information and reporting requirements stemming from the *Drinking Water Protection Act*, the Drinking Water Protection Regulation, and the Action Plan for Safe Drinking Water in BC. From there, data needs were determined, reviewed, and validated, and a core data set was developed.

By March 2006, a technical analysis was completed, which looked at existing data systems and data quality, availability, and accessibility. In addition, a data model and conceptual architecture were developed to demonstrate how data collection and data management could work across disparate information management systems and data sources. A gap analysis was completed, which revealed the need for major capital asset development in order to achieve the desired outcomes; the need to clean up existing data, which would require substantial time and money; and the need to collect new data in order to complete an inventory of drinking water systems consistent with the core data set.

In 2006/2007, the Ministry of Environment took a lead role in developing a plan to address gaps in existing systems and data sets and to develop the means to provide required information to drinking water stakeholders. In developing this plan, the Ministry of Environment worked closely with the Ministry of Health to ensure health information system initiatives were incorporating known drinking water data needs where appropriate. In coming years, new information system initiatives in multiple ministries will address several drinking water data gaps. Data management and reporting tools being developed by government will begin to support stakeholder needs for source-to-tap drinking water information.

The need for better information systems has been identified in a number of reports, including the 2007 Provincial Health Officer's report *Progress on the Action Plan for Safe Drinking Water in British Columbia*. Despite some movement toward the goal, considerable time has passed without having a working application that achieves the vision identified in 2003. A higher priority needs to be given to the development of improved information management systems if the vision is to be realized.

The Vancouver Island Drinking Water Inventory Mapping Project

The Vancouver Island Health Authority has undertaken a drinking water inventory mapping project to update existing information the health authority has in its databases about water systems in its region.

The data being updated includes information about water system owners and operators; the population served by the water system; the system's classification; the volume of water used and whether the system is metered; treatment and disinfection methods used; the number of pressure zones in the distribution system and the size and type of water storage tanks; whether there is a map of the water system and an emergency response plan; and whether the system owner prepares annual reports. New information is also being collected, including maps of the water system; the GPS coordinates of major system components such as wells, surface water intakes, water treatment plants, water disinfection facilities, water storage tanks, and sampling sites; pictures of these components; and risk assessment screening tools.

Data has been collected from 804 of 945 water systems on Vancouver Island and is being shared with the Ministry of Environment to feed into the drinking water information initiative.

Section 4: Water System Assessments

Drinking water system assessments are critical to gaining an understanding of the state of BC's drinking water supplies and what needs to be done to improve them. For instance, systems that have been assessed high hazard ratings can be assigned higher priority for infrastructure or other improvements. The Ministry of Community Services provided nearly 180 grants to communities to help them plan for infrastructure upgrades.

In 2005/2006 and 2006/2007, inconsistencies remained in how hazard ratings for water systems were assigned by drinking water officers. While more than 2,000 water systems were inspected during the reporting period and more than 4,000 of the province's 4,591 water supply systems had current hazard ratings, data collection and reporting was inconsistent and incomplete. By the end of the reporting period, 535 systems had yet to be rated.

The assessment tool developed by an inter-ministerial team during the last reporting period (the Comprehensive Source-to-Tap Assessment Guideline) is being used by drinking water officers in the health authorities. The tool will be revised based on an evaluation carried out during the reporting period.

4.1 Effective Strategies

No changes were made to the strategies related to water system assessments in Part 3 of the *Drinking Water Protection Act* and Section 15 of the Drinking Water Protection Regulation (discussed in the 2007 report, *Progress on the Action Plan for Safe Drinking Water in BC*).

4.2 Aligned Management Systems

Planning Grants

The Ministry of Community Services provides grants to communities to help them plan for infrastructure upgrades. The grants have been used for engineering studies, infrastructure assessments, water metering pilot projects, water treatment plans, well protection plans, and so on. In 2005/2006, 102 projects were funded to a total of nearly $900,000. In 2006/2007, 76 projects were funded at just over $700,000. In both fiscal years, the majority of the grants were valued between $5,000 and $10,000. These grants are listed in Appendix B.

Well Protection Toolkit

The Well Protection Toolkit shows communities, in six steps, how to develop and put into place a well protection plan to prevent contamination of their groundwater supply. The seven booklets in the toolkit discuss the six steps and give

examples of how each step is implemented in a fictitious community. The toolkit was originally produced in 2001. In 2005/2006, it was revised to ensure consistency with the legislative amendments made under the *Drinking Water Protection Act* and the Ground Water Protection Regulation. The toolkit is available at http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/acrobat.html.

Comprehensive Source-to-Tap Assessment Guideline

In 2005/2006, the Ministry of Health initiated an evaluation of the Comprehensive Source-to-Tap Assessment Guideline to determine its effectiveness. The guideline's intended audience includes professionals conducting the assessments, drinking water officers, and water suppliers. The evaluation was completed in 2006/2007 and identified aspects of the guideline that need to be revised. The document will be modified in 2007/2008 to reflect the changes agreed upon by the Ministry of Health and the Drinking Water Leadership Council.

4.3 Performance Measurement and Reporting

Drinking Water Systems Inspected and Hazard Ratings Assigned

In 2006/2007, more than 2,000 drinking water systems in the province were inspected and more than 4,000 systems were assigned a hazard rating. The numbers of inspections are shown by health authority in Table 10.

Different hazard rating systems are used in different health authorities. In some cases, hazard ratings are based on the results of inspections; in others, they are based on known, inherent risks associated with a system. For instance, the Interior Health Authority bases hazard ratings on the inherent risks of a water supply system rather than concerns identified during site inspections. The health authority recognizes that it would be desirable to integrate these inherent risks with the risks identified during inspections. In the Fraser Health Authority, on the other hand, hazard ratings are based on the presence of critical and/or sanitation and maintenance hazards identified during inspections. In the Vancouver Coastal Health Authority, hazard ratings are assigned based on the professional judgement of drinking water officers or other inspectors during inspections. Moderate or high hazard ratings may be assigned in cases where monitoring or emergency response planning is lacking. In the Northern Health Authority, hazard ratings are assigned based on a combination of an inspector's on-site observations and historical knowledge of the water system. In all cases, the hazard rating systems used by health authorities are a relative ranking scale intended to prioritize staff activities to reflect risk reduction priorities.

The numbers of low, medium, and high hazard ratings in each health authority are given in Table 11.

In First Nations communities, the Environmental Health Services program of Health Canada's First Nations and Inuit Health Branch is developing risk assessments for many of the province's smaller First Nations water systems that rely on untreated water supplies.

Click for Table 10 data

Table 10 Number of drinking water systems inspected, by health authority, 2006/2007

Health Authority	# Water systems inspected
Vancouver Island	541
Northern	531
Vancouver Coastal	188
Interior	689
Fraser	438
Total	**2,387**

Click for Table 11 data

Table 11 Hazard ratings for drinking water systems, by health authority, 2006/2007

Health Authority	Low	Medium	High
Vancouver Island	761	92	39
Northern	718	77	34
Vancouver Coastal	119	45	35
Interior	449	937	266
Fraser	334	126	24
Total	**2,381**	**1,277**	**398**

In addition to voluntary water system assessments, drinking water officers in the Vancouver Coastal Health Authority ordered three assessments to be completed. They also ordered eight assessment response plans, three of which were completed in 2006/2007.

During the reporting period, drinking water officers in the Fraser Health Authority issued three hazard abatement orders against water system owners. They also received one request for an investigation regarding logging impacts on groundwater and wells.

Section 5: Water Treatment and Distribution

Water treatment and distribution are at the heart of providing clean, safe and reliable drinking water to consumers. Without proper treatment and distribution system operation, public health is at risk.

In BC, all public drinking water supplies collected from surface water sources such as lakes and rivers must be disinfected. Similarly, where a drinking water officer believes that a groundwater source is at risk of containing pathogens, the water supplier must provide disinfection. Close to 900 drinking water systems in the province disinfect their water and just over 400 of these also provide filtration. Data provided by health authorities do not include the total number of systems in the province that rely on surface water sources; consequently, the number of systems relying on surface water without disinfection or filtration cannot be determined.

Systems must be run by certified operators and other qualified professionals. While the number of certified operators in the province has risen from 1,400 to 1,600 in recent years, more work needs to be done. At least 1,200 systems need to improve the certification status of their operators. It is a similar situation with the number of water systems that have been classified based on their level of complexity; while close to 1,000 systems have been classified, nearly three times as many have not. Classification of systems and operator certification go hand-in-hand.

On a positive note, the vast majority of water systems (more than 3,000) in the province have been issued operating permits. More than 650 of these have conditions on the permits. Unfortunately, while the number of systems that have an emergency response or contingency plan in place has increased in recent years (from 425 in 2004 to nearly 1,500 in 2007), a significant number of systems (mostly serving fewer than 300 connections) do not have an adequate, or in many cases any, emergency response plan in place.

As discussed in the previous report, the province's physical drinking water infrastructure is aging and much of it needs to be upgraded or replaced. Infrastructure funding programs are working to improve this situation. Indeed, from the start of the programs until the end of the 2006/2007 fiscal year, the combined Canada-British Columbia Infrastructure Program and the BC Community Water Improvement Program had improved drinking water quality for 20 per cent of British Columbians. This number is expected to jump to 72 per cent once the Seymour-Capilano water filtration plant (serving Metro Vancouver) is completed in 2009.

During the reporting period, 883 construction permits were issued for improvements and extensions to existing drinking water systems as well as for new systems. To streamline procedures for issuing construction permits and for maintaining and repairing infrastructure, amendments were made to the Drinking Water Protection Regulation in

December 2005. For instance, qualification requirements for individuals running very small water systems with limited operational requirements have been reduced to make them more realistic. Amendments were also made to the *Escheat Act* to make it possible for the provincial government to turn escheated systems and their operation over to local governments.

The following pages describe these programs and issues in greater detail.

5.1 Effective Strategies

Drinking Water Protection Regulation Amendments

Two of the amendments to the Drinking Water Protection Regulation made in December 2005 affect drinking water treatment and distribution facilities. First, professional engineers who have been approved by a drinking water officer can now issue construction permits. This change allows drinking water officers who are not engineers to delegate plan review and approval to public health engineers rather than requiring an engineer to be appointed as a drinking water officer. Second, a person with specialist knowledge can undertake maintenance or repairs if they follow procedures approved by a certified operator. This change allows people who are experts in areas such as reservoir cleaning or repair to undertake work without the need for constant on-site supervision by an operator, but retains a role for the operator to ensure these specialists do not inadvertently interfere with proper system operation. Similarly, very small systems with limited operational requirements can be operated by a person with training specific to that system, where they follow procedures established by a certified operator. This resolves a significant problem discussed in the previous Provincial Health Officer Report for those very small, simple systems where the day-to-day owner/operator could not meet the hands-on operational time requirements for certification.

Escheat Act Amendments

The *Escheat Act* deals with ownerless property. Property becomes vested in the Province, as owner of last resort, when a corporation dissolves. By 2005, 11 corporations owning and operating drinking water systems had dissolved, leaving the BC provincial government as the owner of last resort.

The *Escheat Act* was amended in 2006 to specifically deal with the circumstances of escheated water systems. In brief, the amendments:

- Authorize the Attorney General to dispose of a water system property at any time after the property has escheated to or vested in the government.
- Authorize the Attorney General to grant a right of way or easement over other escheated land if the Attorney General disposes of the water system property.
- Make it possible for a revived company to apply to the court for the return of the water system property if the Attorney General has not disposed of it.
- Authorize fees and charges to be set for providing water from water system property.
- Require an owner to pay interest on unpaid fees and charges.
- Authorize the government to cease providing water from the water system property.
- Clarify that the government is not required to repair or provide water from a non-functioning water system.
- Make a deferral agreement for payment possible under certain circumstances.
- Make it possible for the government to register the deferral agreement and a lien in the Land Titles Office, and to file a certificate with the British Columbia Supreme Court.
- Authorize regulations to be made.

At the time of the amendments, the province owned 11 escheated properties that were drinking water systems. By default, the provincial government became the owner and operator of these systems, providing drinking water to the local community. The amendments make it possible for the provincial government to turn these systems and their operation over to local governments.

By March 31, 2007, three systems had already successfully transferred: two to the users and one to a local government. As well, any immediate water quality or system operational issues associated with the other escheated systems had been addressed.

5.2 Aligned Management Systems

Construction Permits

In 2006/2007, the regional health authorities issued 893 construction permits for drinking water systems. Table 12 shows the breakdown of permits issued by health authority. Approval processes in the Interior Health Authority have slowed due to an increase in the complexity of construction permit applications (related to the higher degree of complexity in treatment now required) and an increase in the number of applications being received.

Conditions may be attached to construction permits. In some cases, a phased approach may be agreed upon and accepted. When construction permits are issued for the significant expansion of drinking water systems that do not meet the current drinking water treatment objectives, conditions can be included on the permit requiring system improvements to be made according to timetables agreed upon by water suppliers and the drinking water officer.

Facility Classifications

As of February 15, 2007, the Environmental Operators Certification Program (EOCP) had classified a total of 970 drinking water facilities in BC. This number is up from 421 in 2004, with the biggest increase in the number of classified small water systems.

Even though water treatment facilities are classified separately from water distribution systems, they are always associated with a distribution system. Consequently, the total number of water supply systems that have been classified may actually be 893, with 77 systems having both their treatment facility and distribution system classified.

Classifications are broken down by complexity of water system, from I (the least complex) to IV (the most complex). A small water system designation is used for facilities serving up to 500 people. Table 13 shows the breakdown of facility classifications, by level.

Click for Table 12 data

Table 12 Number of construction permits issued by health authority, 2006/2007

Health Authority	Number issued for improvements	Number issued for extensions	Number issued for new systems	Total number issued	
Vancouver Island	-	-	-	296*	
Northern	30	41	14	85	
Vancouver Coastal	11	12	10	33	
Interior	-	-	-	314	
Fraser	20	132	13	165	

Notes: *Number of permits issued for 2006 calendar year
- no data provided

Click for Table 13 data

Table 13 Facility classifications, as of February 15, 2007

Type of System	Classification Level					Total
	IV	III	II	I	Small Water System	
Water Distribution	33	41	125	124	570	893
Water Treatment	10	22	35	10	-	77
Total	**43**	**63**	**160**	**134**	**570**	**970**

Source: Environmental Operators Certification Program

As mentioned, the number of classified facilities has increased since September 2004. The number of classified water treatment facilities has risen from 56 to 77 (with increases at each level). The number of classified water distribution systems, including small water systems, has increased from 365 to 893. The largest jump is in the number of classified small water systems, which has gone from 134 to 570.

Given that there are more than 4,000 drinking water systems in the province, the vast majority of water systems, especially small water systems, remain unclassified.

For more information on the classification process for facilities, see the EOCP website at http://www.eocp.org.

Operating Permits

Operating permits are issued to drinking water system owners by drinking water officers. The numbers of systems operating with and without operating permits are listed in Table 14, along with the number of systems operating with conditions on their permits.

It is generally recognized that there are many systems that meet the regulatory definition of a water supply system, but which remain unknown to drinking water officers and therefore operate with no regulatory oversight.

In the Vancouver Island Health Authority, some water systems have no operating permits because they were not considered water systems until the *Drinking Water Protection Act* came into force. The health authority is working to issue permits for all regulated systems.

Emergency Response Plans

Nearly 1,500 drinking water systems in the province have current emergency response and contingency plans in place, while nearly 3,000 have no record of such plans. Despite the fact that a significant number of water supply systems lack an acceptable emergency response or contingency plan as required under the Drinking Water Protection Regulation, significant progress has been made in this area since the regulation came into effect. The total number of emergency response or contingency plans reported for March 31, 2004, was only 425. At that time, the Vancouver Island Health Authority could not provide data on the number of systems that had a plan in place. Assuming that data reported by the other health authorities for 2004 was accurate, close to 1,000 plans have been completed since that time.

The vast majority of systems that have no plan in place serve fewer than 300 connections. Table 15 shows the breakdown by health authority.

Click for Table 14 data

Table 14

Numbers of water systems with operating permits, without operating permits, and with conditions on their permits, by health authority, 2006/2007

Health Authority	Number of systems with operating permit	Number of systems without operating permit	Number of systems with conditions on their operating permits	Most common conditions
Vancouver Island	758	157	19	Specifying water quality monitoring
Northern	1,052	53	334	Bacteriological sampling frequency requirements (if deviate from DWPA requirements), chemical sampling frequency, up-to-date emergency response plan, training and certification requirements
Vancouver Coastal	234	45	120	-
Interior	1,778	(unknown)	156	-
Fraser	484	0	46	Treatment for arsenic
Total	**4,306**	**255**	**675**	

Note: - no data provided

Click for Table 15 data

Table 15 Number of systems with and without emergency response and contingency plans, by health authority

Health Authority	Number of systems with current emergency or contingency plan	Number of systems with no emergency or contingency plan
Vancouver Island	39	965*
Northern	400	703
Vancouver Coastal	133	142
Interior	662	885
Fraser	265	219
Total	**1,499**	**2,914**

Note: *VIHA does not track the number of systems with partially completed emergency response plans or those that are under development

The Interior Health Authority is working to systematically ensure that all systems have emergency response plans in place. A priority are the 85 systems with more than 300 connections serving more than 500 people. Systems with fewer than 300 connections, but which also serve more than 500 people, are the next priority.

In the Northern Health Authority, some of the water systems that have not submitted emergency response plans have not completed them, while others have them on-site but have not provided them to the drinking water officer. Collection is an ongoing process.

Operator Training

Many institutions and organizations provide training for drinking water operators. In BC, the list includes the BC Water & Waste Association (BCWWA), the Water Supply Association of BC, British Columbia Institute of Technology (BCIT), Thompson Rivers University, Simon Fraser University, the University of British Columbia, and correspondence courses through American institutions such as California State University at Sacramento.

During the reporting period, BCWWA, BC Centre for Disease Control Laboratory Services, and Simon Fraser University collaborated to develop a new distance education program for water purveyors. The program continues to be under development.

A wide range of private-sector companies, such as equipment suppliers, also offer training that is recognized for the purposes of certification. Water suppliers can also conduct in-house training that counts toward certification if the EOCP assigns education credits to the training program. A list of training courses that the EOCP has accepted is available from http://www.eocpsearch.org/pdf/CEUAllocationTable.pdf. The EOCP maintains an online form for trainers to submit their course information to have education credits assigned to it. The application costs $50.

BC Water & Waste Association

BCWWA is the largest provider of water operation courses in the province. It is a non-profit association of water and wastewater system professionals with a mandate to provide training opportunities for people working in these industries.

BCWWA holds one- to five-day training courses on a wide variety of water and wastewater system issues. Courses include water treatment (Levels I and II), water distribution (Levels I, II and III), wastewater collection (Levels I, II and III), wastewater treatment (Levels I, II, III/IV), chlorine handling, water sampling, water quality for distribution operators, dam inspection and maintenance, leak detection, confined spaces, shoring and utilities location awareness, unidirectional flushing, and small water and wastewater systems. For more information on BCWWA's course offerings, see http://www.bcwwa.org.

In 2005, BCWWA offered 86 courses for water and wastewater professionals that attracted 1,245 participants. In 2006, these numbers increased to 91 and 1,280, respectively.

Water Supply Association of BC

In April 2005, the Water Supply Association held three, one-day workshops for waterworks managers, administrative staff, and waterworks operators. These workshops were complemented by a two-day annual conference for waterworks managers and a one-day workshop for operators in October 2005. Similar sessions and events were held in 2006. The association liaises with the EOCP to assess and meet training, certification, and classification needs in the province. It also works with the BCWWA and the Small Water Users Association of BC.

Operator Certification

Drinking water treatment and distribution system operators are certified by the EOCP, an independent certification body. Operators who wish to become certified must meet the minimum educational and work experience requirements for the level of complexity of the system they are working on, and must pass certification exams.

The number of certified drinking water operators in the province has increased steadily over the past number of years. The number of certified water distribution operators rose from almost 1,400 in April 2005 to nearly 1,600 in February 2007. The number of certified water treatment operators rose from 182 to 237 during the same period. By February 2007, 1,159 operators were certified to run small water systems, up from 846 in April 2005. These numbers are further broken down by certification level in Table 16. Certification levels are set to match the complexity of the water system (see facility classifications earlier in this report).

This good news is tempered by the fact that a large number of operators working at and running drinking water systems in the province are not certified. While complete numbers are not available, health authorities have indicated that at least 1,200 systems need improvements related to operator certification. The majority of these systems serve fewer than 15 connections. Fewer than 50 are larger systems.

As mentioned in the previous report, managers of some larger water distribution systems, classified as Class III or IV systems, have questioned the need to have their operations overseen by a Level III or IV operator. These systems generally have extensive expertise available within their water department from professional staff such as engineers, technicians and technologists. These people do not qualify for operator certification, but may be able to oversee distribution system operation. The Ministry of Health has been reviewing these special circumstances and acknowledges that the added competencies held by Level III and IV operators over Level II operators relate mostly to higher level mathematics and chemistry, supervision and management principles, and computer skills. If a Level III or IV distribution system owner can demonstrate that his or her operation is adequately managed by a combination of Level II operators and professional engineers, technologists, technicians, and other specialists, it may be appropriate for the government to consider amending the Drinking Water Protection Regulation to accommodate this approach. This option is currently being considered by the Ministry of Health in discussions with the EOCP and managers from large municipal water supplies.

5.3 Performance Measurement and Reporting

Treatment of Drinking Water Supplies

Water supplies from a surface water source, or a groundwater source under the influence of surface water, must be treated. Because these sources are at risk of containing pathogens, the minimum treatment required is disinfection. If the source water is subject to high levels of turbidity, filtration may also be recommended. Table 17 shows the number of water systems, by size and by health authority, which are disinfected (but not filtered). Table 18 shows how many are treated with both disinfection and filtration. These data do not identify the number of systems that lack appropriate treatment, since they

Click for Table 16 data

Table 16 Number of certified operators in BC, by certification level, April 2005 and February 2007

Type of System	Operator Certification Level										Total	
	IV		III		II		I		Small Water System			
	2005	2007	2005	2007	2005	2007	2005	2007	2005	2007	2005	2007
Water Distribution	5	11	83	107	520	650	770	811	846	1,159	2,224	2,738
Water Treatment	6	10	5	9	43	70	128	148	-	-	182	237

Source: Environmental Operators Certification Program

do not differentiate between surface water sources that may require filtration and surface water or groundwater sources that can be adequately treated without filtration. For example, the Capital Regional District achieves acceptable disinfection of its surface water source, which maintains low turbidity, with ultraviolet irradiation, chlorination, and chloramination. In total, 894 drinking water systems in the province are reported to be treated with at least disinfection. Just over 400 of these systems filter their water prior to distribution.

Infrastructure Improvement Programs

The Ministry of Community Services delivers three programs to help water suppliers improve infrastructure. Funding from these programs is available to local governments including municipalities and regional districts.

Canada-British Columbia Infrastructure Program

The program was launched in 2001 and runs until 2008, though the last round of applications was accepted in 2005. Through the program, $398 million has been targeted to water-related projects, $278 million of which is for water treatment and groundwater system improvements.

Canada-British Columbia Municipal Rural Infrastructure Fund

The Canada-British Columbia Infrastructure Program was replaced in 2006 by the Canada-British Columbia Municipal Rural Infrastructure Fund. This program, announced in June 2006, committed more than $150 million to infrastructure projects in 2006/2007. The application process ran from October 2006 until January 2007. More than 300 applications were received. At least 80 per cent of the funding will be

Click for Table 17 data

Table 17

Number of drinking water systems treated with disinfection but no filtration, by health authority and size of system, March 2007

Health Authority	More than 300 connections	15 to 300 connections	2 to 15 connections	1 connection	Total
Vancouver Coastal	7	3	14	-	24
Fraser	17	16	19	4	56
Vancouver Island	-	-	-	-	-
Interior	43	148	141	-	332
Northern	13	16	34	15	78
Total	80	183	208	19	490

Note: - no data provided

Click for Table 18 data

Table 18

Number of drinking water systems treated with both disinfection and filtration, by health authority and size of system March 2007

Health Authority	More than 300 connections	15 to 300 connections	2 to 15 connections	1 connection	Total
Vancouver Coastal	1	2	16	-	19
Fraser	3	4	37	34	78
Vancouver Island	-	-	-	-	-
Interior	22	28	125	-	175
Northern	6	28	68	30	132
Total	32	62	246	64	404

Note: - no data provided

allocated to communities with a population of fewer than 250,000 people. Thirty-three water-related projects have been approved, valued at over $69 million.

BC Community Water Improvement Program
This program builds on the province's commitment to enhance drinking water systems, and has allocated $54 million to drinking water-related projects in BC. All program funds have been allocated. Appendix B provides a list of projects funded under the program.

The Ministry of Community Services' performance measure in this area from its 2007/2008 – 2009/2010 Service Plan report, shown in Table 19, shows the population served by new water treatment facilities funded by grant programs that meet emerging, internationally-recognized best practices and standards for enhanced treatment, such as ultraviolet irradiation and filtration. It provides evidence that communities are building infrastructure using current North American regulatory standards for the treatment of surface water. The measure does not include groundwater, nor does it capture the percentage of the provincial population using infrastructure that is not owned by local government and therefore does not qualify for assistance under federal/provincial grant programs.

Combined, projects funded through the Canada/BC Infrastructure Program and the BC Community Water Improvement Program provided improved drinking water quality to 18.3 per cent of the BC population by the end of 2006/2007.

Arrow Creek Water Treatment Plant

On September 16, 2005, a new state-of-the-art water treatment plant opened to serve the communities of Erickson and Creston, BC. The new facility and water system are owned and operated by the Regional District of Central Kootenay.

The opening of the plant ends a long chapter in the history of drinking water treatment in Erickson. It started in February 1974, when the Medical Health Officer of the East Kootenay Health Unit wrote to the Erickson Irrigation District about the need for the District to disinfect its water due to ongoing water quality concerns. The letter sparked a debate between community members and public health officials that lasted nearly 30 years.

The new Arrow Creek Water Treatment Plant treats the communities' drinking water using a combination of filtration, ultraviolet irradiation, and chlorination.

Click for Table 19 data

Table 19 Performance Measure for the Ministry of Community Services

Performance Measure	2004/05 Actual	2005/06 Actual	2006/07 Forecast	2007/08 Target	2008/09 Target	2009/10 Target
Number and percentage of British Columbians* served by drinking water systems that meet emerging treatment standards** for the protection of drinking water quality.	16.67% of total population served.	17.8% of total population served.	18.3% of total population served.	20.3% of total population served.	71.8% of total population served.	75.6% of total population served.
	Additional 577,770 people with new system.	Additional 57,474 people with new system.	Additional 20,207 people with new system.	Additional 85,400 people with new system.	Additional 2,191,328 people with new system.***	Additional 162,000 people with new system.

Notes: * British Columbia population based on BC Statistics 2005 population average of 4,254,500.
** Current regulatory standards within North America.
*** The significant increase in population served is due to the completion of the Greater Vancouver Regional District water treatment plant, which will serve approximately 50 per cent of the provincial population.

Source: 2007/2008 – 2009/2010 Service Plan: http://www.bcbudget.gov.bc.ca/2007/sp/pdf/ministry/cs.pdf

Section 6: Drinking Water Quality

Drinking water quality is measured through programs that monitor treatment effectiveness and treated water quality. Treatment effectiveness monitoring varies with the type of treatment used. For a system that simply chlorinates, it involves measuring the amount of chlorine in the water and the length of time between chlorination and when the water reaches the first consumer. This calculation allows operators to determine the percentage of pathogens that would have been killed by the chlorine.

Samples of drinking water are taken at the treatment plant and in the distribution system and then sent to laboratories for testing and analysis. In December 2005, the Drinking Water Protection Regulation was amended to require water suppliers to have their water tested for total coliform bacteria and *E. coli*. In 2006/2007, health authorities reported that 823 water systems met the sampling requirements set out in the regulation. The remaining systems did not meet the requirements for a number of reasons. In some cases, a single sample being missed over the course of a year due to delays in transporting the sample to an approved laboratory within the required 30 hours of collection has resulted in non-compliance. As well, many small systems are not being required to collect four samples in a 30-day period, but this has not been formalized on all of their operating permits. Data management systems cannot differentiate between systems that have a reduced sampling frequency specified on their operating permit and those that are simply not collecting the required number of samples. The BC Centre for Disease Control reported that in each of the 2005/2006 and 2006/2007 fiscal years, it tested approximately 65,000 water samples for *E. coli* bacteria. In 2006/2007, 657 samples were reported positive for *E. coli*. The number of samples tested by other approved laboratories is unknown.

In addition to the bacteriological sampling requirements, drinking water officers require water suppliers to test for chemicals and physical parameters on a system-by-system basis. In 2006/2007, health authorities reported that 115 systems tested for parameters such as metals (e.g., arsenic, iron, manganese), nitrates, fluoride, and disinfection by-products such as trihalomethanes. Where levels of contaminants exceed the maximum acceptable concentrations set out in the *Guidelines for Canadian Drinking Water Quality*, drinking water officers discuss the results with the water supplier and may require the public to be notified of any potential health risks. Drinking water officers may also require steps to be taken to improve water quality through treatment or by obtaining a new water source.

6.1 Effective Strategies

Amendments to the Drinking Water Protection Regulation

The December 2005 amendments to the Drinking Water Protection Regulation included a change to the water quality monitoring requirements. Specifically, as of April 1, 2006,

water suppliers must monitor for *E. coli*, rather than being given the option of monitoring for either *E. coli* or fecal coliform bacteria. It is generally accepted that *E. coli* are a better indicator of drinking water contamination than fecal coliforms. Further, if requested by a drinking water officer, a laboratory must now provide to the drinking water officer, the water supplier, or both, a report listing all water samples sent to the laboratory by the water supplier describing the results of all monitoring analyses for *E. coli* and total coliform bacteria. This amendment is intended to address situations where laboratories have not immediately reported that a sample could not be tested. While this is not normally a critical issue, it can interfere with the investigation of an adverse water quality incident. Generally speaking, samples will not be tested if too much time passes between collection and arrival at the laboratory, if temperatures during transit are not maintained appropriately (for instance, if samples arrive at the laboratory frozen), or if the sample bottle breaks. Because laboratories are required to immediately report all samples that test positive for *E. coli*, the lack of such a report has occasionally been taken to mean that the sample sent to the laboratory did not contain *E. coli* when, in fact, the sample had not been tested at all. It is still necessary, however, for the person submitting the sample to ask laboratory staff to notify them of the status of the sample.

6.2 Aligned Management Systems

Policy Manual for Drinking Water Officers

As discussed in Section 3.2, the Drinking Water Leadership Council completed and published the *Drinking Water Officers' Guide* in January 2006. The guide promotes the effective, consistent, and transparent administration of the *Drinking Water Protection Act* and the Drinking Water Protection Regulation. It provides policy and procedural guidance to the public health officials responsible for administering the Act and regulation. The guide, excluding the appendices, has been approved by the Minister of Health as a "guideline" under Section 4 of the Act. Thus, drinking water officials must consider this guide in exercising their duties and discretion. The guide will be updated periodically as new information is needed or becomes available. Amendments will be vetted through the Drinking Water Leadership Council.

All drinking water officers and their delegates in the province have received a copy of the guide. Training has been provided at locations throughout the province to ensure all staff exercising authority under the *Drinking Water Protection Act* have a thorough understanding of the guide's intent, its content, and how to use it.

Training Courses for Water Sampling

BCWWA offered courses on water sampling during 2005/2006. In addition, BCWWA collaborated with the BC Centre for Disease Control Laboratory Services Division and Simon Fraser University to develop a new distance education program for water purveyors. The program is under development.

6.3 Performance Measurement and Reporting

Bacteriological Sampling and Analysis

Health Authorities

The Drinking Water Protection Regulation requires water suppliers to take samples of their water supply for bacteriological testing and analysis by Provincial Health Officer-approved laboratories. In 2006/2007, 1,638 water systems are reported to have met the bacteriological sampling frequency requirements set out in Schedule B of the regulation. Table 20 shows the number of systems meeting these requirements, by health authority and system size.

Approximately 2,953 water supply systems did not meet sampling frequency requirements. The reasons for not meeting the sampling frequency requirements vary. In the Northern and Interior Health Authorities, for instance, getting samples to a laboratory from isolated sampling sites can take a long time and if a sample arrives at a laboratory more than 30 hours after collection it will not be analysed. Arranging transportation can be difficult and costly. In addition, some water systems may still have old operating permits that do not list sampling frequencies as a condition of operation. Operators of these water systems may not be aware of the current bacteriological sampling frequency requirements; they may still be collecting samples at the frequency previously required of them. Considering that missing a single sample

out of the dozens to hundreds required per year will result in a water supply system being non-compliant, the compliance rate is actually quite good.

The Northern Health Authority is working with operators as it becomes aware of low frequency sampling. Many isolated water systems are not open for significant periods of the year, while some isolated water systems are able to analyse water samples with testing methods that indicate the presence or absence of bacteria. Drinking water officers can use their discretion to require different sampling frequencies than otherwise required by Schedule B of the Drinking Water Protection Regulation.

In 2006/2007, health authorities reported that a total of 808 samples were contaminated with either fecal coliforms or *E. coli* (see Table 21). The BC Centre for Disease Control reported that a total of 657 of the samples tested in its laboratory were positive for *E. coli*. The difference between reported positive samples by health authorities and the BC Centre for Disease Control reflects the fact that analysis results from private laboratories on contract to the BC Centre for Disease Control or working directly for water suppliers are not included in BC Centre for Disease Control data.

The reporting of positive samples was done under the Drinking Water Protection Regulation's "immediate reporting requirement" which allows rapid follow-up by water suppliers and drinking water officers. Follow-up includes resampling, checking other water quality monitoring and treatment performance results, issuing public advisories or notices, and fixing any identified problems.

In First Nations communities in 2006/2007, a total of 24,000 water samples were analyzed for bacteriological quality. Thirty-four per cent of these were analysed by accredited laboratories and 66 per cent were analysed in community bacteriological laboratories. In total, *E. coli* were isolated in 1.1 per cent of all samples analysed, and total coliforms in 8.2 per cent. Community water quality technicians and community laboratories are established and supported by Environmental Health Officers in 136 First Nations communities throughout BC.

Click for Table 21 data

Table 21 Number of positive bacteriological samples, by health authority, 2006/2007

Health Authority	Number of samples that tested positive for fecal coliforms or *E. coli*
Vancouver Island	43
Northern	205*
Vancouver Coastal	9
Interior	528
Fraser	23
Total	**808**

Note: *This number covers 2005/06 and 2006/07 and is high in part because of the Northern Health Authority's requirement that systems on boil water notices continue to sample

Click for Table 20 data

Table 20 Number of water systems meeting the bacteriological sampling frequency requirements, by health authority and system size, 2006/2007

	Number of systems in each health authority meeting bacteriological sampling frequency requirements						
Water system size	Vancouver Coastal	Fraser	Northern	Interior	Vancouver Island	Total	
More than 300 connections	10	25	4	67	7	113	
15 to 300 connections	9	91	35	253	59	447	
2 to 15 connections	-	125	121	495	47	788	
1 connection	-	119	83	-	88	290	
Total	**19**	**360**	**243**	**815**	**201**	**1,638**	

Note: - data not available

BC Centre for Disease Control Laboratory Services and Approved Laboratories Under Contract to the Centre

During 2005/2006 and 2006/2007, the BC Centre for Disease Control Laboratory Services spent more than $1 million per year testing drinking water samples for bacteria. In 2005/2006, these laboratories tested 83,124 water samples; in 2006/2007, they tested 79,329 samples. These numbers represent an increase of more than 7,900 samples and 4,100 samples, respectively, compared to the numbers tested in 2003. The number of samples tested at other approved laboratories not affiliated with the Centre are unknown.

The monthly percentage of drinking water samples that tested positive for *E. coli* and that were tested through the BC Centre for Disease Control Laboratory Services are shown in Table 22. As required by regulation, positive *E. coli* results were reported by telephone to the medical health officer, the drinking water officer, and the water supplier. Calls are made for all results that may be positive (presumptive positive), since confirmation of a positive result can take a few days. The apparent increase in the number of samples and the percentage of samples testing positive between 2005/2006 and 2006/2007 reflects changes in laboratory methodology to a more sensitive screening test, rather than the degradation of water quality.

Sampling for Chemical and Physical Parameters

In addition to bacteriological sampling, 115 water systems in the province are reported to sample their water supplies for chemical and/or physical parameters. This type of sampling may look for metals (such as arsenic), fluoride, pesticides, or nitrates and nitrites, or measure characteristics such as temperature, pH, taste, and odour. Table 23 shows the number of systems in the province reported to have undertaken this type of sampling in 2006/2007, by system size.

In the Northern Health Authority, chemical sampling is required as a condition on operating permits at a frequency ranging from once every one to five years. Sampling frequency is based on an assessment of health risks associated with the water source and the complexity of the water treatment regime in place.

Click for Table 22 data

Table 22 BCCDC Laboratory Services monthly fecal coliform / *E. coli* positive drinking water samples

	2005/2006			2006/2007		
Month	**# of drinking water samples**	**# of positive fecal coliform reports (%)**	**# of telephone calls made for critical reporting**	**# of drinking water samples**	**# of positive *E. coli* reports (%)**	**# of telephone calls made for critical reporting**
Apr	5389	35 (0.65)	35x3=105	4923	29 (0.59)	28x3=84
May	6007	60 (1.00)	66x3=198	6016	59 (0.98)	67x3=201
Jun	6582	77 (1.17)	66x3=198	6006	67 (1.16)	101x3=303
Jul	5762	62 (1.08)	94x3=282	5581	71 (1.27)	106x3=318
Aug	6304	100 (1.59)	113x3=339	6398	97 (1.52)	132x3=396
Sep	5526	42 (0.76)	45x3=135	5536	62 (1.12)	77x3=231
Oct	5010	60 (1.2)	61x3=183	5369	50 (0.93)	57x3=171
Nov	5253	36 (0.69)	39x3=117	4582	61 (1.33)	66x3=198
Dec	3741	14 (0.37)	16x3=48	3846	48 (1.25)	48x3=144
Jan	5138	21 (0.41)	24x3=72	5295	38 (0.72)	40x3=120
Feb	5003	23 (0.46)	23x3=69	5065	33 (0.65)	35x3=105
Mar	5756	29 (0.50)	26x3=78	5316	42 (0.79)	27x3=81
Total	**65471**	**559 (0.85)**	**1824**	**63933**	**657(1.04)**	**2352**

Click for Table 23 data

Table 23 Number of water systems that undertook chemical sampling, by health authority and system size, 2006/2007

Water system size	Number of systems in each health authority which undertook chemical sampling					
	Vancouver Coastal	Fraser	Northern	Interior*	Vancouver Island	Total
More than 300 connections	10	22	8	3	-	43
15 to 300 connections	6	-	8	10	-	24
2 to 15 connections	-	1	43	32	-	76
1 connection	-	13	4	-	-	17
Total	**16**	**36**	**63**	**45**		**160**

Notes: * Where water suppliers conduct their own chemical monitoring programs, data may not be entered into the health authority database. More water supply systems are monitoring for chemical parameters than reported.
- no data provided due to data management system limitations

Water chemistry data are not readily available from health authority databases, making it difficult to report whether sampling has been undertaken, for which parameters, and what the results were. Anecdotal reports from health authorities indicate that the chemicals most commonly exceeding the *Guidelines for Canadian Drinking Water Quality* are arsenic, uranium, and nitrates (all of which originate in source waters), trihalomethanes (formed during disinfection), and lead (which leaches from plumbing materials).

Where guidelines are exceeded, drinking water officers discuss the results with the water supplier and may require the public to be notified of any potential health risks. Drinking water officers may also require that steps be taken to improve water quality through treatment or by obtaining new water sources. In June 2006, for example, in response to a new Canadian drinking water guideline for arsenic (with a guideline level of 10 parts per billion), the Fraser Health Authority produced a one-page fact sheet of health information about arsenic and began developing a guidance document to help public health inspectors address water supplies containing arsenic. Arsenic is found in groundwater supplies throughout much of the Fraser Health Authority at levels above the guideline. This situation affects many private wells and several small public water supplies, including a school that will be installing a treatment device. In the interim, the school is providing students with bottled water.

Information about water chemistry can be obtained directly from a water supplier upon request, or from the supplier's annual report or website, where applicable.

Section 7: Small Systems

Ensuring people in small communities have access to high quality drinking water has long been a challenge in BC. Since December 2005, small systems have been defined by the Drinking Water Protection Regulation as those serving fewer than 500 people per day. Amendments to the regulation at that time gave small systems greater flexibility with respect to operator qualifications and in choosing point-of-use and point-of-entry treatment devices as a way of treating drinking water in very small communities.

Small water supply systems are often underfunded because of their small tax base and because costs of treating drinking water are not proportionate to population size. In many cases, the population served by the system are opposed to the rate increases that would fully fund necessary infrastructure upgrades or proper operation. Large urban communities can realize cost savings because they operate on a much larger scale and can generally access financial assistance from federal and provincial grant programs. Water supply systems not owned by local governments have to fund operations and improvements through their water rates unless they are able and willing to access resources through local governments. This option may require a transfer of ownership of the water system to the local government. Such transfers of ownership are often seen as undesirable to the community due to potential rate increases or loss of autonomy. Conversely, local governments, such as regional districts, may see them as undesirable because they will then own a water supply system that does not meet regulatory requirements, posing a liability to the government.

In order to better understand the relationship between small systems and regional districts and to explore options for improving the way small systems are managed, the Ministry of Health initiated a survey of regional districts, undertaken by the Ministry of Community Services. The survey found that the regional districts manage 115 "local service area" water systems, three-quarters of which serve 300 or fewer connections. One-third of the systems have public health concerns including unsustainable water sources, untreated water, aging infrastructure, inadequate cross-connection controls, and bacterial re-growth in the distribution system. In many cases, though, small systems benefit from conversion to regional district ownership. Benefits include access to government funding programs, qualified operators, technical assistance, more sophisticated management (including access to technology), and shared assets and other economies of scale. The survey revealed that regional districts are willing to consider more conversions as long as some key issues are addressed, such as liability, financial support, and clear commitments from the people served by the water supply system to see the process through.

Over the past few years, the provincial government, health authorities, water supply associations, and others have put considerable effort into understanding the challenges facing small systems and developing new support mechanisms.

These include programs for small community water systems that deal with Supervisory Control and Data Acquisition (SCADA) solutions, group loans, and access to liability insurance; publications related to capacity building, sustainable operations, and pricing; studies and surveys of the management of small water systems and the use of point-of-use and point-of-entry water treatment devices; and courses and training opportunities for operators of small water systems.

7.1 Effective Strategies

Amendments to the Drinking Water Protection Regulation

As discussed in Section 1.1, the provincial government amended the Drinking Water Protection Regulation in December 2005. The amendments included defining small systems as those serving fewer than 500 people per day. Some of the changes gave small systems greater flexibility with respect to operator qualifications and in choosing point-of-use and point-of-entry treatment devices as a way of treating drinking water in very small communities. Small systems that do not provide water for human consumption or food preparation are exempt from the potability requirements of the *Drinking Water Protection Act* (such as Ministry of Transportation rest stops that provide water for toilet flushing and handwashing).

The regulation was also modified to clarify that bottled water and drinking water dispensing machines, regulated under other legislation, are not covered by the *Drinking Water Protection Act*.

7.2 Aligned Management Systems

Sustainable Infrastructure Society: Support for Small Systems

Located on the University of Victoria campus, the Sustainable Infrastructure Society was created in 2005 to help develop and apply technology and resources for building the managerial, financial, and operational capacity of small community water suppliers in BC. The Ministry of Health and the University of Victoria's Innovation and Development Corporation provided support for its establishment.

During 2005/2006 and 2006/2007, the Society developed an affordable Group Liability Insurance Program for small community water suppliers, in collaboration with industry partners. The Society developed a rating system that is completed by a supplier when applying for liability insurance. The system indicates the degree of insurance risk posed by the water supply and calculates premiums payable based on this information. The rating system can be expanded to be used for other applications such as a tool to support innovative funding programs for water suppliers. The program has been well received and provides significant savings to small water suppliers. Between the fall of 2006, when the program was initiated, and March 2007, 30 small water suppliers signed up and about 100 more were in the process of investigating the program. Examples of insurance rates for small water suppliers before and after signing up for the program are shown in Table 24.

According to the Sustainable Infrastructure Society, extremely small water suppliers were paying approximately $5,000 per year for liability insurance. Under the group insurance program, these suppliers are now paying closer to $2,000 per year for the same coverage.

In 2006/2007, the Society collaborated with industry partners on two additional projects for small community water suppliers: affordable SCADA solutions and an affordable group loan program. The SCADA program stems from the fact that many small water systems are limited in their ability to monitor and control their water systems. The technology generally used to help with these functions is geared towards large and complex operations. This project is scaling down the technology to make it more usable for small water system

Click for Table 24 data

Table 24 Examples of insurance rates for small water suppliers

	Expiring liability insurance premium	SIS group liability insurance premium
Client A	$ 6,250	$ 2,244
Client B	$ 13,032	$ 3,652
Client C	$ 16,368	$ 5,500
Client D	$ 12,350	$ 5,500

Source: Sustainable Infrastructure Society

users and is investigating access to well-qualified operational assistance. A pilot project on Vancouver Island was underway in 2005/2006 and 2006/2007.

In conjunction with the SCADA program, the Society is also developing an Operational Assistance Program to make the services of qualified operators available under contract to small water supply organizations.

The Society is investigating an Access to Funding Program intended to enable small water suppliers to access money from lending institutions to help upgrade their infrastructure. Access to loans from credit unions and other organizations will help water suppliers pay for improved water treatment, SCADA systems, and other infrastructure elements.

Information about the Society, and access to its programs and support, are available through its website: http://www.sustainis.org.

Resources for Small Systems

In 2005/2006, the Ministry of Health contracted with the Sustainable Infrastructure Society to develop two publications for small water systems. These documents are available on the Sustainable Infrastructure Society website at http://www.sustainis.org/community/programs/funding.

The Ministry of Community Services, in partnership with the Ministry of Health and Ministry of Environment, has started to develop a web page dedicated to small community infrastructure. The ultimate goal is to create a single point of contact for information related to smaller community and smaller system issues. The page will address drinking water, wastewater, and stormwater and rainwater management, as well as related subject areas such as groundwater, energy efficiency, and First Nations issues. The web page has a stand-alone URL (http://bc.smallcommunityinfrastructure.ca), which is hosted by Waterbucket.ca. It will ultimately become a "community of interest" on the Waterbucket.ca homepage. The provincial government has committed to develop this website, given the province's need and desire to help small communities manage and operate their water, wastewater, rainwater, and energy infrastructure. The site is designed to be a valuable, user-friendly tool for small system owners, managers, and operators.

Point-of-Entry/Point-of-Use Research Project

In 2005/2006, the Ministry of Health contracted with Aquavic Water Solutions Inc. to develop a report on how point-of-use and point-of-entry treatment devices could be used by certain small water systems to address drinking water potability. The report included:

- Flexible guidelines for using point-of-use and point-of-entry devices.
- Implementation and integration issues.
- Monitoring and maintenance requirements.
- Source water profiles and treatment solutions.
- Administrative and regulatory issues.
- History of use in BC and elsewhere.
- Technical summaries of various technologies.
- A review of consultations undertaken with specialists, regulators, community water system representatives, and regional water association representatives.

The report is available on the Ministry of Health website at http://www.health.gov.bc.ca/protect/dwpublications.html.

Subsequently, the Sustainable Infrastructure Society produced several documents about point-of-entry and point-of-use technology, including:

- An introduction to point-of-use/point-of-entry technology.
- Planning considerations.
- A guidebook to the application of the technology.
- Worksheets for small water systems interested in using the technology.

In order to help prepare these documents and to facilitate pilot projects for using the technology, the Society set up an advisory group with the assistance of the Ministry of Health. The advisory group is made up of representatives from the regional health authorities. The documents have been made available to the members of the advisory group and can be downloaded from the Society's website at http://www.sustainis.org.

Training and Information Sessions

Ministry of Health

In 2005/2006, the Ministry of Health held information sessions for small water system owners across the province about the *Drinking Water Protection Act* and regulatory amendments. For instance, in February 2006, it held a small focus group session with about 30 representatives from organizations working with small water systems, including water and industry associations, regional districts, and provincial government ministries and agencies. The intent was to give information about the regulatory changes that participating organizations could pass on to their members. The Ministry also partnered with BCWWA, EOCP, and Thompson Rivers University to ensure there were ongoing training and certification sessions available for small systems operators.

Thompson Rivers University

In 2005/2006, Thompson Rivers University's WaterSafe course went live. WaterSafe is a basic course for owners and operators of small water systems. It provides critical information about water sources, monitoring, treatment, storage, and distribution, and information about the responsibilities of small water system owners and operators. Successful completion of the course includes WaterSafe certification. Since its inception in February 2006, 90 students have registered in the course. Information about this course is available at http://www.watersafebc.ca.

Small Water Users Association of British Columbia

The Small Water Users Association of British Columbia supports small water suppliers in the province through educational workshops and newsletters. It has also developed a guide to online resources for small water systems (http://www.smallwaterusers.com/publications.htm). As of March 2007, the association had 218 members representing small water systems. It works closely with the BCWWA, the Water Supply Association of BC, the Coastal Water Suppliers Association, and the BC Ground Water Association to exchange information and coordinate scheduling for events.

Between May 2005 and November 2006, the association, in partnership with health authorities, held six, one-day workshops that attracted more than 500 people representing more than 250 water systems. In addition to providing networking opportunities, the workshops addressed topics such as operator certification and training, liability risks and insurance, infrastructure planning grants, water microbiology, the use of point-of-entry treatment devices, groundwater regulations, source water protection, and compliance with the *Drinking Water Protection Act*. More information about the association's events can be found online at http://www.smallwaterusers.com/events.htm.

BC Water & Waste Association

During 2005/2006, BCWWA offered 30 courses for small water systems with 492 registrants. A small water system management course is under development.

Small Roadside Water Facilities

The Ministry of Transportation is responsible for the safety of drinking water at roadside facilities, including rest areas. These responsibilities include small systems operation and sampling and testing water samples. During the reporting period, the Ministry worked to educate regional and district staff about the requirements for operating these systems, developed appropriate signage for drinking water advisories for sites that did not have potable or treated water, and ensured that designated personnel took the appropriate training.

7.3 Performance Measurement and Reporting

Survey of Regional Districts

One of the greatest challenges faced by small water systems is their overall capacity to finance operations and system improvements. An opportunity to address capacity issues is to shift ownership or management of small systems to regional districts.

In 2005/2006, the Ministry of Health initiated a survey of regional districts. The survey was led by and undertaken by the Ministry of Community Services. The objective of the survey was to develop an understanding of the relationship between small community water systems and regional districts in order to explore options for improving the way these small systems are managed. The survey covered issues of governance and management, operation of service areas, public health and infrastructure concerns, and conversions of small systems to regional district service areas. In January

2006, the Ministry of Community Services published a report, *Capacity Building for Small Water Systems: Survey of Regional Districts*. The report was subsequently modified based on input from a provincial steering committee. The final version, produced in June 2007, is available at: http://drinkingwater.smallcommunityinfrastructure.ca/sites/scis-drinking/documents/media/3.pdf.

The survey found that the 24 regional districts in BC manage 115 "local service area" water systems serving more than 26,000 connections, with a range of four to 3,000 connections. The majority of these systems (76 per cent) serve 300 connections or fewer. About one-third have public health concerns including an unsustainable water source, untreated water, aging infrastructure, lack of cross-connection control, and bacterial regrowth in the distribution system. Twelve of the systems managed by regional districts were on long-term boil water notification at the time of the survey.

The survey also found that regional districts generally do not have a significant relationship with small water systems that are not a service area system. In fact, the regional districts only reported an awareness of 800 systems not under their management when the actual number is more than 4,000.

The benefits that small systems have gained by conversion to regional district ownership include:

- Access to government funding programs.
- Access to a qualified operator.
- Technical assistance.
- Transfer of liability to the regional district's insurance.
- Access to grants.
- Ability to borrow money.
- Long-term stability with respect to accountable management of the system.
- More sophisticated management including access to technology.
- Access to shared assets and other economies of scale.

Despite these benefits, only 90 water suppliers applied for conversion to regional district ownership between 2000 and 2005. The lack of interest to convert may reflect the fact that regional districts generally do not approach small system owners, who may not be aware of the conversion option. Regional districts also reported that many suppliers are reluctant to lose their autonomy and experience the large rate increases that may be associated with the upgrades that regional districts may require as part of taking on ownership of the system.

The survey revealed that regional districts are generally willing to consider more conversions as long as some key issues are addressed: liability to the regional district, financial support, and clear commitment from the people relying on the water supply system to see the process through.

Section 8: Full-Cost Accounting

The Action Plan for Safe Drinking Water in BC states that "water should be affordable with users paying appropriate costs." During the reporting period, some progress was made to improve the affordability of water by reducing costs to consumers, and to ensure that consumers are paying for the actual costs of providing safe water, even if this means rate increases.

Full-cost accounting is a process that ensures water suppliers are funding all water system costs through their basic water rates, neither subsidizing water supply system costs through other revenue streams (general tax base), nor deferring costs of future infrastructure or operational needs.

Water rates should be structured to cover day-to-day needs as well as long-term considerations. They should reflect population growth, the replacement of aging infrastructure, the training of operators, and contingency needs. At the same time, water rates should be affordable to the people paying them.

One of the greatest challenges is to determine what affordable means to different people, many of whom feel that water should be free. The actual cost to the water supplier of water licensing fees is relatively low for surface water. There is no fee for groundwater, which is unlicensed. The bulk of the cost of providing drinking water rests in the infrastructure needed to collect it, the treatment plants needed to make it safe, the distribution systems needed to transport it to users, and the operational costs.

The final cost of providing drinking water to the consumer varies greatly across the province: from pennies per cubic metre to more than a dollar per cubic metre. For instance, customers of the Comox Strathcona Regional District were billed approximately 33 cents per cubic metre in 2006, while residential customers of the Capital Regional District were billed approximately $1.14 per cubic metre. In some cases, sewage costs are built into water rates, raising the cost per cubic metre closer to $2.00. Even where rates are relatively high, the cost of a day's worth of water for drinking purposes (usually about 1.5 to 2 litres per day) is less than a penny per person. Most of the cost of the average water bill comes from covering other household water needs such as bathing, sanitation, and watering lawns and gardens. In all cases, however, the true cost of water is associated with the expenses associated with the acquisition, operation, maintenance, monitoring, and administration of intake structures, and treatment and distribution facilities. Conservation efforts can reduce the demand on treatment plants and distribution systems and reduce the overall costs of a water supply system. In BC, the government is considering options to improve water efficiency to help water suppliers reduce demand and the associated costs, and to ensure that available supplies will be sufficient to meet the needs of expanding populations. Where water is not metered, property owners generally pay a flat rate for their water as part of their taxes, leaving no incentive for responsible water use and conservation.

The assessments conducted by health authorities and water suppliers discussed in Section 4 will help to improve planning for long-term needs, while access to affordable liability insurance through the Sustainable Infrastructure Society's group liability insurance program can greatly reduce insurance costs for small water suppliers. Amendments to the Drinking Water Protection Regulation that accommodate the use of point-of-use and point-of-entry treatment for small water supply systems may allow for more cost-effective treatment for small communities. Similarly, the greater flexibility in operator qualifications (discussed in Section 7.1) will alleviate training costs for some small water supply systems without compromising safe operations.

8.1 Effective Strategies

Amendments to the Drinking Water Protection Regulation

As discussed in Sections 1.1 and 7.1, the provincial government amended the Drinking Water Protection Regulation in December 2005. The amendments included defining small systems as those serving fewer than 500 people per day. Some of the changes gave small systems greater flexibility with respect to operator qualifications and in choosing point-of-use and point-of-entry treatment devices as a way of treating drinking water in very small communities. Small systems that do not provide water for human consumption or food preparation are exempt from the potability requirements of the *Drinking Water Protection Act* (for instance, Ministry of Transportation rest stops that provide water for toilet flushing and handwashing). These amendments will provide opportunities for small water supply systems to improve water quality while containing costs.

Amendments to the *Escheat Act*

As discussed in Section 5.1, amendments were made to the *Escheat Act*, which make it possible for the provincial government to address water systems that have come under provincial ownership when a corporation dissolves, by transferring ownership over to local governments or other parties. Systems that have escheated to date are all small systems. This transfer allows the new owner to manage the system in a fiscally responsible manner, with appropriate user rates and, where local government assumes ownership, to access federal/provincial grant programs.

8.2 Aligned Management Systems

To appropriately manage a water supply system's finances, it is necessary to have a full understanding of the financial needs of the system. Assessments conducted by water suppliers, combined with information from health authority inspections, will help water suppliers identify and prioritize their infrastructure and operational needs, develop budgets, and set appropriate rates. Data systems do not currently allow detailed analysis or reporting of progress made by water suppliers to identify and prioritize their financial needs and develop full-cost accounting programs.

Point-of-Use and Point-of-Entry Treatment

As discussed in Section 7.2, a significant amount of work has been undertaken to help small water supply system owners improve their water systems in the most cost-effective way without compromising public health. Progress made towards solving treatment challenges through point-of-use and point-of-entry treatment units will ultimately allow small systems to affordably provide effective treatment. The Drinking Water Leadership Council has been working with BC Hydro, BC Parks, and the Ministry of Transportation to develop compliance strategies for their small water supply systems. This work will include pilot programs that will help other small water supply system owners select appropriate and affordable treatment units.

Exemption from the Potability Requirement

The amended Drinking Water Officers' Guide provides advice on how to evaluate whether a water supply system is exempt from potability requirements because it does not provide water for drinking or food preparation. This exemption will allow people who own some small systems to realize significant cost savings. Systems that may meet these criteria are those that exist solely to supply bathrooms at roadside rest stops, marinas, or parks, or showers at mobile work camps where other supplies are available for drinking and food preparation purposes. In these cases, it may be possible to provide water appropriate for flushing toilets, washing hands, or showering without providing the full treatment required to make the water safe to drink.

Small System Operator Qualifications

The ability of drinking water officers to specify operator qualifications rather than simply require small system certification of operators is intended to ensure that such systems are properly operated without the added costs associated with training programs that may not be relevant to the particular system.

Affordable Insurance

Another significant step towards reducing the costs faced by small water suppliers has been the development of an affordable Group Liability Insurance Program for small community water suppliers, as discussed in Section 7.2. This program, developed by the Sustainable Infrastructure Society with Ministry of Health funding, provides water suppliers with access to insurance at substantially lower rates than previously available.

Between the fall of 2006, when the Group Liability Insurance Program for small community water suppliers was initiated, and March 2007, 30 small water suppliers signed up for the program. Another 100 were in the process of investigating the program.

Laboratory Testing Costs

During the reporting period, the Drinking Water Leadership Council received updates from the BC Centre for Disease Control regarding the number of water samples being tested at the cost of the Centre, either through the BC Centre for Disease Control laboratory, or at laboratories under contract to the Centre. As discussed in Section 6.3 (and in the 2007 report on *Progress on the Action Plan for Safe Drinking Water in British Columbia*), the number of samples tested by the BC Centre for Disease Control has increased significantly in recent years. In addition to increasing the cost to the Centre, the increased subsidized testing is contrary to the principle that users should pay appropriate costs for their water. To this end, drinking water officers have been asking many larger water suppliers to move their monitoring to approved laboratories at their own cost. This is easily accommodated by larger water supply systems at a relatively low cost per consumer. Both the Capital Regional District and Metro Vancouver have been testing their own water samples at their own laboratories for many years. Smaller systems are still having their samples tested through the BC Centre for Disease Control program.

8.3 Performance Measurement and Reporting

Improved Treatment for Small Water Supply Systems

The 2005/2006 and 2006/2007 fiscal years were transition periods for regulations to improve flexibility for small water supply systems. To date, little progress has been made toward actually implementing point-of-entry or point-of-use treatment solutions. It is not possible to report out on the cost-effectiveness of these options.

Escheated Water Supply Systems

Progress was made on escheated water systems. By March 31, 2007, three systems had already been successfully transferred: two to the users and one to a local government. With clear ownership, these systems are in a position to move forward with improvements to their infrastructure and operational costs.

Section 9: Recommendations

While significant progress has been made to address many of the gaps identified in the 2007 report *Progress on the Action Plan for Safe Drinking Water in British Columbia*,[16] much remains to be done. This section looks at the previous recommendations and provides commentary on progress made to date, which has been provided by the agency named as the lead for responding to the recommendation. New and revised recommendations for 2008 are also given. Since the Ministry of Healthy Living and Sport (MHLS) was created in 2008, and responsibilty for the *Drinking Water Protection Act* was transferred to it from the Ministry of Health, this Recommendation section will refer to the new ministry in the comments and new recommendations. Clearly the speed of future progress will be dependent to a significant extent on adequate investments.

Recommendation 1

2007: Provincial and federal government commitments to the Environmental Farm Plan Program should remain a priority, with a target of all farms participating in the program. (Lead: Ministry of Agriculture and Lands)

Since its inception in 2003 until the end of 2006/2007, the Environmental Farm Plan Program held more than 1,000 workshops for almost 4,000 farm producers on how to complete an environmental farm plan. These plans can include provisions for conserving water and for protecting water sources from degradation, such as by encouraging livestock to drink from watering stations located away from streams.

In 2006/2007, the target was for 800 farms to have developed such plans. This target was exceeded, with a total of 1,565 farms having developed plans.

The Environmental Farm Plan Program continues to be funded and the Ministry of Agriculture and Lands will continue to support the program, subject to available funding.

2008: The federal and provincial governments should continue to fund the Environmental Farm Plan Program. (Leads: Agriculture and Agri-food Canada, Ministry of Agriculture and Lands)

Recommendation 2

2007: The Ministry of Environment should continue to expand its activities to support drinking water officers in meeting government's source protection commitments and report out to the public on its activities. Staff at the regional level should have a clear understanding of their role in providing support to water suppliers and drinking water officers in their source protection activities. (Lead: Ministry of Environment)

Further clarification is required about elements of land-use legislation that protect source water.

[16] *This report covered the period of May 2003 to March 31, 2005.*

2008: Government should identify priorities for source water protection initiatives and ensure action is coordinated across government agencies and health authorities. (Lead: Ministry of Healthy Living and Sport)

Recommendation 3

2007: To ensure comprehensive management of BC's drinking water sources, especially where water quantity is threatened, government should introduce legislation requiring the licensing of ground water extraction and restricting access to ground water where aquifers are being over-used. Ground water licensing should complement surface water licensing. (Lead: Ministry of Environment)

There are currently no plans to establish groundwater licensing on the scale of surface water licensing. However, Phase 3 of the Ground Water Protection Regulation may include area-based regulation of groundwater extraction. Groundwater licensing or regulation may be implemented after a water management plan is completed for an area.

Under the *Water Act*, groundwater extraction can be licensed and restricted for a designated area. However, the authority of the Lieutenant Governor in Council is required in order to carry out such licensing and restrictions. Historically, universal regulation or licensing of groundwater use across the province has been generally opposed, although regulation may be appropriate in areas where aquifers are under stress from over-use. For example, the water management plan currently under development for the Township of Langley may require drilling authorizations for all new wells.

2008: Where groundwater use threatens to significantly deplete aquifers, government should initiate water protection planning processes and require groundwater licensing where appropriate. (Lead: Ministry of Environment)

Recommendation 4

2007: Government should improve monitoring of the impacts of resource activities on drinking water sources to ensure adverse impacts on water quality can be identified. Clear responsibilities for monitoring need to be established and the parties responsible for impacts on water supplies should be held accountable. (Leads: Ministry of Environment, Assistant Deputy Ministers' Committee on Water)

The ministries represented on the Assistant Deputy Ministers' Committee on Water and the health authorities have entered into a Memorandum of Understanding (MOU) on Inter-Agency Accountability and Coordination on Drinking Water Protection (see Section 3). This MOU establishes clear responsibilities for monitoring. Additionally, the Ministry of Environment, the Ministry of Forests and Range, the Ministry of Transportation, and the Ministry of Energy, Mines and Petroleum Resources have mechanisms in place and have undertaken initiatives to improve the monitoring of resource activities that could impact water quality.

2008: Government should continue to improve monitoring for potential impacts of resource activities on drinking water. Monitoring should either be undertaken by the parties conducting the resource activity or by government. (Leads: Ministry of Healthy Living and Sport, Assistant Deputy Ministers' Committee on Water)

Recommendation 5

2007: The Ministry of Environment and Ministry of Agriculture and Lands should work to gain a better understanding of how different land-use practices can influence drinking water sources. (Leads: Ministry of Environment, Ministry of Agriculture and Lands, Ministry of Health, and research and granting agencies)

The Ministry of Agriculture and Lands promotes land-use practices that minimize impacts on drinking water sources through a number of programs (see Section 2). The Ministry works with the Ministry of Environment and Ministry of Healthy Living and Sport to ensure policies and programs are based on the most current knowledge.

The Ministry of Environment and the Ministry of Agriculture and Lands will work together through the regional teams developed as a part of the MOU for Inter-agency Accountability and Coordination on Drinking Water Protection. The regional teams, which include representatives from the Ministry of Healthy Living and Sport and the health authorities, will discuss and improve understanding of the impacts of local land-use practices on local drinking water sources. Where the science is insufficient to link land-use activities to source water quality impacts, the ministries will consider pursuing or funding projects in collaboration with research and granting agencies that help further understanding of these linkages.

2008: Government should continue to evaluate the potential impacts of activities on source water quality, including the benefits and weaknesses of different land-use management practices. (Leads: Ministry of Agriculture and Lands, Ministry of Healthy Living and Sport, and research and granting agencies)

Recommendation 6

2007: Government should complete the process for water management plan development to include ground and surface water source areas. This process should accommodate formal planning under both the Water Act *and the* Drinking Water Protection Act, *as well as planning occurring outside of a statutory decision. Where source water assessments show drinking water sources to be at risk from land use, or where source contamination has led to water quality advisories or identified outbreaks, watershed management plans should be developed. (Leads: Ministry of Environment, Ministry of Health, and water suppliers)*

Comprehensive management plans are needed for many watersheds and groundwater recharge areas, particularly where land use threatens source water quality. While considerable effort has been made to ensure drinking water values are considered in land-use management legislation, the impact of any one activity on a water source often remains difficult to evaluate. Obligations are seldom placed on land users to maintain long-term programs to monitor their impact on water quality, quantity, or timing of flow. Water suppliers and drinking water officers continue to express concerns that the land users who benefit from their activity are not being held accountable to demonstrate that they are protecting water quality.

The Ministry of Healthy Living and Sport, the health authorities, the Ministry of Environment, and water suppliers are developing joint planning processes to address drinking water source concerns in areas where assessments show that drinking water sources are at risk from land-use activities and/or have been contaminated, resulting in water quality advisories or identified outbreaks. For instance, in the Comox Lake watershed, the Ministry of Healthy Living and Sport, the Ministry of Environment, and the Vancouver Island Health Authority have been considering planning options to address drinking water health hazards.

The Township of Langley is currently engaged in a planning process under an order made pursuant to the i. One outcome will be a template for water management planning that will inform the establishment of planning processes under both the *Water Act* and the *Drinking Water Protection Act*. Further efforts will be required to encourage similar planning processes elsewhere.

2008: Government should complete the process for developing drinking water protection plans. The process developed should complement planning under the Water Act. Where source water assessments show drinking water sources are at risk from land use, or where source contamination has led to water quality advisories or identified outbreaks, drinking water protection plans should be developed. (Leads: Ministry of Healthy Living and Sport, Ministry of Environment, and Ministry of Community Development)

Recommendation 7

2007: The systematic collection of better information about drinking water quality conditions in the province is needed. The drinking water information management project needs to be completed to ensure drinking water officers and the Provincial Health Officer have ready access to all data needed to administer and report on activities under the Drinking Water Protection Act. These data include those

needed to hold water suppliers, drinking water officers, and the government accountable through public reporting. (Leads: Ministry of Healthy Living and Sport and Ministry of Environment)

The provincial government, health authorities, and water suppliers continue to be challenged by their inability to readily access data about water supplies that could improve land-use decisions and information about land uses that could help water suppliers and drinking water officers manage risks to source water. This fact is evident from the difficulties that health authorities had providing data for this report and the fact that much of the requested information was not available. The Ministry of Environment, on behalf of the Assistant Deputy Ministers' Committee on Water, has been leading the drinking water information initiative, which will establish a plan for cross-government data sharing.

Specific challenges include the following:

- Current data management systems do not yet fully support public reporting at a provincial level. The absence of a province-wide, real-time tracking system for water quality data makes it difficult to report out on basic public health measures such as water quality advisories and notices, their causes, and the priority measures government needs to take to help water suppliers address water quality concerns that result in advisories and notices.
- Health authority databases need to be capable of capturing water chemistry data. Electronic reporting systems should be developed that will allow laboratories to transmit data directly into a health authority's database.

The Ministry of Healthy Living and Sport is working closely with the health authorities to establish a common data management system for all health authority environmental health/health protection data. Funding has been identified for the development of an Environmental Health/Health Protection application that meets the needs of the health authorities and the province. This component of the BC-Yukon Public Health Information Project is part of a larger health data management initiative that will provide a consistent system for collecting drinking water data across the province, and link the drinking water information initiative to a broad range of data users and to a broad range of public health data, facilitating disease surveillance and research.

While improving information collection and data sharing continues to be a priority for both the Ministry of Environment and the Ministry of Healthy Living and Sport, it remains unclear what commitment exists to ensure the linkages of the relevant data repositories in various ministries. Adequate resources to achieve the vision of the drinking water information initiative will need to be found.

2008: An Environmental Health/Health Protection Application should be completed by December 2009. A system to allow government staff, health authority staff, water suppliers and their agents, and the general public to access all data relevant to drinking water systems or drinking water protection, which is not subject to protection of privacy requirements, should be developed by December 2010. (Lead: Ministry of Health)

Recommendation 8

2007: Where government activities affect the safety of drinking water, the decision makers responsible for the activity must ensure that they involve the appropriate health officials, either within the Ministry of Healthy Living and Sport or within the regional health authority. (Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water)

A primary gap identified in the previous report was the absence of clear procedures between decision makers in different ministries for referrals and routine business. This gap flows largely from the fact that legislation governing land use generally does not include an internal mandated referral process involving health authorities. Government officials must ensure that appropriate referrals take place as a routine part of business regardless of statutory mandate.

This important gap has been largely addressed through the MOU on Inter-Agency Accountability and Coordination on Drinking Water Protection. Draft referral protocols have been written (in October 2007). Further work is required at a regional and provincial level to ensure the MOU is effective.

The effect of this MOU will be reported on in greater length in future reports.

The Ministry of Healthy Living and Sport, other resource ministries represented on the Assistant Deputy Ministers' Committee on Water, and the health authorities will work together through the regional drinking water teams to ensure health authorities and/or the Ministry of Healthy Living and Sport are involved in land-use decision-making that may impact drinking water sources.

2008: Regional drinking water teams established under the Memorandum of Understanding for Inter-Agency Accountability and Coordination on Drinking Water Protection should develop protocols to ensure decisions that affect the safety of drinking water involve the appropriate health officials, either within the Ministry of Healthy Living and Sport or within the regional health authority. (Leads: Ministry of Healthy Living and Sport and regional drinking water teams)

Recommendation 9

2007: All ministries and government agencies should regularly review their activities in the context of government's commitment to an integrated approach to drinking water protection. (Lead: Directors' Inter-Agency Committee on Drinking Water)

The Ministry of Healthy Living and Sport, as secretariat for the Directors' Inter-Agency Committee on Drinking Water, continues to emphasize the importance of sharing information about each ministry's programs, initiatives, and proposed legislative changes with the Directors' Committee early in their development process. The Ministry of Healthy Living and Sport will work with the Directors' Committee to identify areas where broader ministry representation on the Committee may be warranted.

2008: Ongoing commitment to integrating government activities should remain a priority of the Assistant Deputy Ministers' Committee on Water. The need for cooperation across agencies should be communicated by member Assistant Deputy Ministers to other Assistant Deputy Ministers within their ministry and to field staff. (Lead: Assistant Deputy Ministers' Committee on Water)

Recommendation 10

2007: All government policy decisions related to land use or water management that could have an impact on the province's drinking water program should be taken to the Assistant Deputy Ministers' Committee on Water to ensure that policy direction is consistent with the Action Plan for Safe Drinking Water in British Columbia. The work of the Assistant Deputy Ministers' Committee on Water should be made more transparent; its decisions should be made publicly available. (Leads: Ministry of Health, Assistant Deputy Ministers' Committee on Water)

Two of the key functions of the Assistant Deputy Ministers' Committee on Water are to ensure an integrated approach to drinking water protection and provide a forum for resolving policy issues that affect drinking water. The Committee's secretariat is taking steps to provide a meeting summary and record of decision on a publicly accessible website within ten days of each meeting. Completion of the website is expected in December 2008.

As of October 2007, each ministry is represented on the Assistant Deputy Ministers' Committee on Water (with the exception of the Ministry of Aboriginal Relations and Reconciliation and the Ministry of Public Safety and Solicitor General) and each health authority is represented on the regional drinking water teams developed under the Memorandum of Understanding for Inter-Agency Accountability and Coordination on Drinking Water Protection. Drinking water source concerns resulting, or thought to result, from land-use activities that cannot be resolved at the local level will be brought to the attention of the Directors' Inter-Agency Committee on Drinking Water and subsequently to the Assistant Deputy Ministers' Committee on Water for further discussion and action as appropriate.

2008: The Directors' Inter-Agency Committee on Drinking Water should develop protocols to ensure all government policy decisions related to land use or water management that could have an impact on the province's drinking water program will be taken to the Assistant Deputy Ministers' Committee on Water to ensure that policy direction is consistent with the Action Plan for Safe Drinking Water in British

Columbia. The work of the Assistant Deputy Ministers' Committee on Water and the Directors, Inter-Agency Committee on Drinking Water should be made more transparent; minutes of their decisions should be made publicly available by December 2008. (Leads: Ministry of Environment, Ministry of Healthy Living and Sport)

Recommendation 11

2007: All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans, health authorities should require water suppliers relying on surface water sources to plan for treatment capable of achieving 99.99 per cent reduction in virus levels, 99.9 per cent reduction in protozoa levels, and turbidity levels below 1 NTU, through treatment processes involving at least two barriers, unless there is good justification, acceptable to the drinking water officer, for not achieving those levels. (Lead: Health authorities)

While significant progress has been made to assess all water systems in the province, the large number of systems and their resource limitations continue to make it difficult to assess all systems and to update assessments as improvements are made, as changes occur within watersheds or groundwater recharge areas for wells, as infrastructure deteriorates, and as operational conditions change. On a positive note, most health authorities are using the risk assessment tool included in the *Drinking Water Officers' Guide*.

The continuing absence of a comprehensive database for recording the results of assessments is of even greater concern. Some data have been entered into existing health authority or water supplier data systems; however, much more data exist in paper-based reports. Data about the location of potential sources of contamination for water sources exist in databases maintained by several government ministries, but they are still not readily accessible to water suppliers or drinking water officers in an electronic format clearly linked to the assessment process.

The most conspicuous gap is the lack of comprehensive information about the state of treatment plants and distribution systems. This information is needed in order to properly report in this area. Much has been done to fill this gap through system assessments; however, improved databases and information management systems are required in order to access and report on the data.

In terms of the recommended treatment requirements, many public water supply systems, particularly smaller systems, regularly fail to meet basic standards for bacteriological water quality and sampling frequency requirements. Many water suppliers are not providing treatment capable of effectively reducing risks from protozoa. Frequently, some supplies relying on unfiltered surface water sources experience high levels of turbidity, resulting in aesthetically unpleasant water and potentially compromised treatment effectiveness.

That said, all of the health authorities are moving towards more stringent requirements for treating surface water and groundwater under the influence of surface water. Most are in the process of adopting 4-3-2-1 treatment objectives, especially for large or new systems. Improvements are more challenging for small systems, which are unable to access the capital and funding required to make upgrades. More information about the challenges facing small systems is found in Section 7.

2008: All water suppliers need to undertake thorough assessments of their systems and develop assessment response plans. Health authorities need to ensure that all water suppliers have established time frames to complete the assessments. In evaluating assessment response plans, health authorities should require water suppliers relying on surface water sources to plan for treatment capable of achieving 99.99 per cent reduction in virus levels, 99.9 per cent reduction in protozoa levels, and turbidity levels below 1 NTU, through treatment processes involving at least two barriers, unless there is good justification, acceptable to the drinking water officer, for not achieving those levels. Health authorities should also ensure that all small water supply systems understand the sampling frequency requirements. Where appropriate, sampling frequencies should

be included on operating permits. Efforts should be made by stakeholders to reduce the number of systems on long-term boil water advisories, while ensuring the health of the community through improvements in water quality delivered to citizens. (Leads: Health authorities, drinking water suppliers, local authorities)

Recommendation 12

2007: Government should consider options to improve access to funding support for public water supply systems that are currently ineligible for federal/provincial infrastructure assistance. (Lead: Ministry of Community Services)

The lack of adequate infrastructure, particularly drinking water treatment systems in smaller communities that rely on surface water sources, remains a major gap. This situation is further compounded by the fact that infrastructure grant funding available through federal/provincial programs, which allows local governments to improve their treatment, is generally not available to small systems.

2008: Government should improve access to funding support for public water supply systems that are currently ineligible for federal/provincial infrastructure assistance, where there is a long-term strategy in place to ensure continuing viability of the system. The provincial government should ask the federal government to establish an equitable framework for accessing federal assistance for water supplies not recognized by current federal government funding programs, to facilitate conversion of ownership to local governments. (Lead: Ministry of Community Development)

Recommendation 13

2007: Based on the needs identified by [illegible]ents and the requirements stipulated on op[illegible] permits, water suppliers should implement or ex[illegible]reatment performance monitoring to include varia[illegible]uch as CT, filtration performance, turbidity, UV performa[illegible]ce, pH, and pressure regimes as appropriate. (Leads: Water suppliers, drinking water officers)

All of the health authorities agree that this type of monitoring is worthwhile. Some have requirements in place, especially for larger systems where it is most practical. Some health authorities are looking to incorporate requirements for treatment performance monitoring on operating permits.

2008: Based on the needs identified by assessments and the requirements stipulated on operating permits, water suppliers should implement or expand treatment performance monitoring to include variables such as CT, filtration performance, turbidity, UV performance, pH, and pressure regimes as appropriate. (Leads: Water suppliers, drinking water officers)

Recommendation 14

2007: To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged. (Leads: BCCDC and EWQA)

Laboratories have been approved in the Fort St. John area and Calgary, providing improved access to laboratory support for water suppliers in the Peace region and the East Kootenays. Water suppliers in many remote areas continue to have difficulty reliably transporting all of their water samples to approved laboratories within the required 30 hours of collection. A survey of drinking water officers and environmental health officers in priority areas, such as the Kootenay region, is needed to determine whether the current network of laboratories needs to be further broadened.

It may be appropriate to consider allowing water suppliers to test water samples in-house for drinking water treatment quality assurance purposes, using commercially available test kits. The use of these test kits would augment, not replace, laboratory analysis. This approach is used on First Nations reserves.

According to the BC Centre for Disease Control Laboratory Services, the number of samples collected for microbiological testing of drinking water rose dramatically after the enactment of the *Drinking Water Protection Act* and regulation. Although exact data is difficult to obtain because of the lack of optimal information management at the present time, it appears that the number of samples submitted per year has now stabilized.

2008: To ensure all public water supply systems have improved access to laboratory testing of water samples, a broader network of approved laboratories should be encouraged. The use of on-site test kits to augment testing at remote locations should be promoted. (Leads: BC Centre for Disease Control, Enhanced Water Quality Assurance Steering Committee, Ministry of Healthy Living and Sport)

Recommendation 15

2007: Government should undertake to develop an accurate inventory of BC's small public drinking water supply systems and obtain all of the data identified as part of the drinking water information management project core data set. (Leads: Health authorities, Ministry of Health)

All of the health authorities and the Ministry of Healthy Living and Sport agree that an accurate inventory of small public drinking water supply systems would be beneficial. They recognize, though, that there are practical limitations to identifying and collecting information about very small systems, especially in remote areas. Limitations include the lack of a disclosure mechanism for water suppliers and a lack of in-house capacity to search for such systems.

All of the health authorities also recognize the value of obtaining the data identified as part of the drinking water information management project core data set. A great deal of data has been collected to date, especially through pilot projects on Vancouver Island and in the Interior. However, health authorities report significant challenges with data entry given the limitations of current databases. They encourage the government to develop a comprehensive provincial data management system to house the data and allow for proper reporting.

2008: Health authorities and the provincial government should develop an accurate inventory of BC's small public drinking water supply systems and obtain all of the data identified as part of the drinking water information management project core data set. (Leads: Health authorities, Ministry of Healthy Living and Sport)

Recommendation 16

2007: Strategies should be developed to prevent the creation of new small water supply systems where other supplies could be expanded or existing supplies amalgamated. These strategies should include regulatory amendments that:

a) Prohibit the creation of multiple small water supply systems where one larger system could be developed.

b) Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.

c) Provide authority to require developers to connect new properties with existing adjacent water supply systems.

(Lead: Ministry of Community Services)

No legal authority exists to readily allow the province to prohibit the proliferation of small private systems during the subdivision process, nor to move them toward amalgamation or transfer of ownership to local government once they are created. The Survey of Regional Districts reported on in *Capacity Building for Small Community Water Systems*, published in June 2007, provides an overview of opportunities that exist for addressing many small system challenges through the transfer of ownership to local governments. A working group of the Directors' Inter-Agency Committee on Drinking Water is developing a strategy to address this recommendation.

2008: Government should pursue legislative change to allow decision makers with the Ministries of Transportation and Environment, health authorities, and local governments to:

a) Prohibit the creation of multiple small water supply systems where one larger system could be developed.

b) Facilitate extensions of local government boundaries to allow expansion of local government-owned water supply systems.

c) Provide authority to require developers to connect new properties with existing adjacent water supply systems.

Local governments should be required to address the issues of non-viable small water supply systems in growth management strategies. (Leads: Ministry of Community Development, Assistant Deputy Ministers' Committee on Water)

Recommendation 17

2007: To follow up on the Action Plan for Safe Drinking Water in British Columbia, public drinking water system suppliers should engage their customers in fiscal planning for maintaining and upgrading their systems over the short- and long-term. In addition, small water supply systems should be offered assistance to develop revenue streams to fund assessments, response plans, and system upgrades. (Leads: Ministry of Health, Ministry of Community Services, and water suppliers)

The Sustainable Infrastructure Society (SIS), through funding assistance from the Ministry of Healthy Living and Sport and in collaboration with industry partners, has developed an affordable Group Liability Insurance Program for community water suppliers in BC. This program has been established for well-managed small and medium-sized community water suppliers.

The SIS is also in the process of establishing other programs to assist with fiscal planning and funding for small water systems, such as an affordable group loan program for community water suppliers in BC and a municipal water rate structure and rate setting program to assist small water systems in establishing water rates that reflect the cost of providing safe drinking water to customers.

2008: Government should continue to develop assistance for small water supply systems to help them plan for ongoing maintenance and system upgrades. Suppliers should be required to proceed with upgrades through conditions on their operating permits. (Leads: Ministry of Healthy Living and Sport, Ministry of Community Development, health authorities)

Recommendation 18

2007: Rates for drinking water should reflect the true, long-term costs of water treatment, distribution and water system operation, maintenance, and monitoring. Revenue generated from charges for water should be re-invested in programs that promote awareness of water quality and quantity, protect water quality, improve public health, and encourage sustainable water use to promote healthy communities. (Lead: Ministry of Community Services)

No substantial progress has been made by government to ensure that all water suppliers are moving toward sustainable funding of their operations and infrastructure requirements. A number of projects, such as access to less expensive liability insurance, as well as the regulatory amendments facilitating point-of-entry treatment and allowing reduced treatment requirements where water will not be used for drinking or food preparation will result in reduced costs to water suppliers. Government has not developed a process to ensure that all suppliers are assessing their financial needs and developing rate structures to meet those needs. Where fiscal oversight exists, such as for local governments and utilities, it requires suppliers to justify rate increases, but does not demand the full cost recovery necessary to assess infrastructure or operational improvement requirements. Where referendum processes are required, these processes can impede informed professional staff and elected officials where the rate payers do not understand the need for improvements and are motivated to keep rates low.

2008: Rates for drinking water should reflect the true, long-term costs of water treatment, distribution and water system operation, maintenance, and monitoring. Revenue generated from charges for water should be re-invested in programs that promote awareness of water quality and quantity, protect water quality, improve public health, and encourage sustainable water use to promote healthy communities. (Lead: Ministry of Community Development)

Appendix A: The Enhanced Water Quality Assurance Program Audit Checklist

Enhanced Water Quality Assurance

University of British Columbia,
Department of Pathology and Laboratory Medicine
Heather Pavilion C364, 2733 Heather Street
Vancouver BC V5Z 1M9
Tel: (604) 875-4432 Fax: (604) 660-6073

UBC

EWQA AUDIT REPORT

Laboratory Name: _____

Address: _____

Director: _____

Contact Person: _____

Send report to:

_____

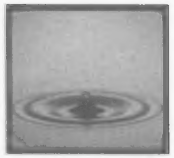
Auditor (Lead):

Auditor:

Observer:

Date of Audit:

Preliminary Report ☐ **Final Report** ☐



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Please check (√) which parameters/methods that the laboratory is seeking approval for, indicate if participating in a proficiency testing (PT) program and provide dates of the last 2 sets of PT samples:

Parameters / Methods	Check	Participating in PT	Dates of Last 2 Sets of PT Samples
Total Coliform / Membrane Filtration			
Total Coliform / MTF (MPN)			
Total Coliform / ESCT - P/A			
Total Coliform / ESCT - Quant			
Fecal Coliform / Membrane Filtration			
Fecal Coliform / MTF (MPN)			
Escherichia coli / Membrane Filtration			
Escherichia coli / MTF (MPN)			
Escherichia coli / ESCT - P/A			
Escherichia coli / ESCT - Quant			

MTF (MPN) : Multiple-Tube Fermentation (Most Probable Number)
ESCT - Quant : Enzyme Substrate Coliform Test – Quantitation
ESCT - P/A : Enzyme Substrate Coliform Test – Presence/Absence

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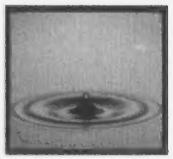
EWQA'S EXPECTATIONS:

- Compliance with the BC *Drinking Water Protection Act* and Drinking Water Protection Regulation.
- Compliance with current Standard Methods for the Examination of Water and Waste Water (American Public Health Association) and other Best Practices and International Standards.

THE EWQA STEERING COMMITTEE WOULD LIKE TO INFORM THE LABORATORY OF ITS RIGHT TO APPEAL ANY PART OF THE AUDITORS' REPORT.



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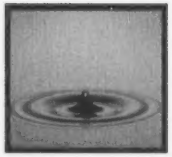
#	ITEM	COMPLIANT (Y/N)	COMMENTS
1	HOURS OF OPERATION		
2	PERSONNEL		
	Numbers		
	Qualifications		
	Experience		
3	LABORATORY FACILITIES		
4	STANDARD OPERATING PROCEDURES (SOP)		
	1. Total Coliform / Membrane Filtration		
	2. Total Coliform / MTF (MPN)		
	3. Total Coliform / ESCT - P/A		
	4. Total Coliform / ESCT - Quant		
	5. Fecal Coliform / Membrane Filtration		
	6. Fecal Coliform / MTF (MPN)		
	7. *Escherichia coli* / Membrane Filtration		
	8. *Escherichia coli* / MTF (MPN)		
	9. *Escherichia coli* / ESCT - P/A		
	10. *Escherichia coli* / ESCT - Quant		
5	EQUIPMENT PERFORMANCE MONITORING		
	Autoclave		
	Incubator		
	pH Meter		



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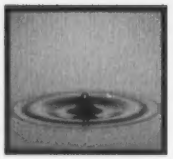
#	ITEM	COMPLIANT (Y/N)	COMMENTS
	Balance		
	Waterbath		
	Ultraviolet Lamp		
	Refrigerators		
6	CALIBRATION		
	Thermometers		
	Weights		
	Pipettes		
	Measuring Cylinders		
7	STERILITY CHECKS		
8	QUALITY CONTROL		
	Reagent Water		
	Dilution/Rinse Water		
	Filtration Apparatus		
	Culture Media - Plates		
	Culture Media - Liquid		
	Culture Tubes and Closure		
	Membrane Filters		
	Batch Testing		
	Control Organisms		
	Recording/Charting		



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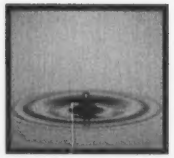
#	ITEM	COMPLIANT (Y/N)	COMMENTS
9	SAMPLING		
	Sampling protocol		
	Sample containers		
	Sample Requisition		
10	SETUP		
11	INCUBATION AND RESULTS		
	Verification		
	Presumptive		
	Completed		
	Confirmed		
12	READING		
13	COUNTING		
14	RECORDING		
15	REPORTING		
	Report Form - Content and Format		
16	IMMEDIATE REPORTING		
	Telephone Log		
	Written Report within 24 hour		
17	PROFICIENCY TESTING		
	1. Total Coliform / Membrane Filtration		
	2. Total Coliform / MTF (MPN)		



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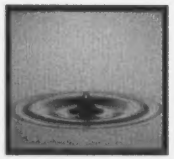
#	ITEM	COMPLIANT (Y/N)	COMMENTS
	3. Total Coliform / ESCT - P/A		
	4. Total Coliform / ESCT - Quant		
	5. Fecal Coliform / Membrane Filtration		
	6. Fecal Coliform / MTF (MPN)		
	7. *Escherichia coli* / Membrane Filtration		
	8. *Escherichia coli* / MTF (MPN)		
	9. *Escherichia coli* / ESCT - P/A		
	10. *Escherichia coli* / ESCT - Quant		



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Major deficiencies (with Reference to Standard Methods):

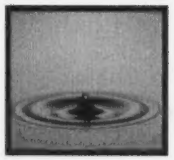
Minor deficiencies (with Reference to Standard Methods):

Auditors' Suggestions for Improvement:

AUDITORS' APPROVAL RECOMMENDATIONS - APPROVE **NOW**

Circle a number

PARAMETER	METHOD
1. Total Coliform	Membrane Filtration
2. Total Coliform	Multiple-Tube Fermentation (Most Probable number)
3. Total Coliform	Enzyme Substrate Coliform Test – Presence/Absence
4. Total Coliform	Enzyme Substrate Coliform Test – Quantitation
5. Fecal Coliform	Membrane Filtration
6. Fecal Coliform	Multiple-Tube Fermentation (Most Probable number)
7. *Escherichia coli*	Membrane Filtration Partition
8. *Escherichia coli*	Multiple-Tube Fermentation (Most Probable number)
9. *Escherichia coli*	Enzyme Substrate Coliform Test – Presence/Absence
10. *Escherichia coli*	Enzyme Substrate Coliform Test – Quantitation



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AUDITORS' ADDITIONAL RECOMMENDATIONS - APPROVE **LATER**

Circle a number

PARAMETER	METHOD
1. Total Coliform	Membrane Filtration
2. Total Coliform	Multiple-Tube Fermentation (Most Probable number)
3. Total Coliform	Enzyme Substrate Coliform Test – Presence/Absence
4. Total Coliform	Enzyme Substrate Coliform Test – Quantitation
5. Fecal Coliform	Membrane Filtration
6. Fecal Coliform	Multiple-Tube Fermentation (Most Probable number)
7. *Escherichia coli*	Membrane Filtration Partition
8. *Escherichia coli*	Multiple-Tube Fermentation (Most Probable number)
9. *Escherichia coli*	Enzyme Substrate Coliform Test – Presence/Absence
10. *Escherichia coli*	Enzyme Substrate Coliform Test – Quantitation

APPROVAL CONDITIONS:

Circle a number

1. Must meet PT requirements

2. Major deficiencies must be corrected to the satisfaction of the EWQA Steering Committee and the appropriate documentation/evidence provided in this regard within the next 3 months and minor deficiencies are to be corrected within the next 6 months from the date of audit.

_____ _____

Signed & Dated Team Leader

_____ _____

Signed & Dated

_____ _____

Signed & Dated

Appendix B: Infrastructure and Planning Grants Awarded

BC Community Water Improvement Program 2005/2006

Proponent	Project Title	Grant Award
Cache Creek	Water Treatment Project	$533,333
Campbell River	Ultraviolet Disinfection Facilties Construction	$2,651,333
Capital Regional District	Revisions to Distribution System - Surfside Water, Mayne Island	$169,104
Central Kootenay Regional District	Ymir Water Phase 2 (CBCIP #9003)	$572,000
Central Kootenay Regional District	South Slocan Water (CBCIP #10173)	$361,023
Central Saanich	Brentwood Revitalization - Watermain Replacement	$196,800
Cowichan Valley Regional District	Integration of Youbou Water System	$1,496,000
Cowichan Valley Regional District	Honeymoon Bay Water System Upgrades (CBCIP #5767)	$322,933
Dawson Creek	Water Quality Assurance Plan	$1,274,000
Hudson's Hope	Water Treatment Plant	$973,333
Kimberley	Mark Creek Power/Chlorination Generation Project	$749,892
Lake Country	Eldorado Storage/Balancing Reservoir	$1,600,000
Lillooet	Lillooet Water Reservoir #1 (High Zone)	$733,333
Lions Bay	Lions Bay Drinking Water Treatment Construction	$1,260,063
Lytton	Well #1 and Well #2 and Storage Completion Project	$1,066,667
New Hazelton	Ninth Avenue Upgrade	$176,667
North Okanagan Regional District	Mission Hill Water Treatment Plant (CBCIP #11251)	$4,531,333
Oliver	Rural Area Water System Twinning (CBCIP #9923) Phase One	$2,066,667
Parksville	Chlorine Disinfection of Railway Wells	$90,000
Qualicum Beach	River Well Field UV Disinfection	$411,333
Radium Hot Springs	Water Disinfection and Storage	$525,333
Salmo	Water Supply and Distribution Improvements	$445,333
Salmon Arm	Shuswap Lake Drinking Water Treatment Plant	$6,560,000
Sparwood	Sparwood Proper Reservoir Reconstruction	$266,667
Squamish-Lillooet Regional District	D'Arcy Water System Upgrade	$306,667
Summerland	Thirsk Dam Expansion - Stage One	$1,058,130
Sunshine Coast Regional District	Davis Bay Watermain Replacement	$200,000
Tofino	Ginnard Creek Water Supply Upgrade	$823,333
		$31,421,277

BC Community Water Improvement Program 2006/2007

Proponent	Project Title	Grant Award
Anmore	Chlorination Booster Station	$44,667
Bowen Island	Cove Bay Water System Universal Metering Project	$162,000
Burns Lake	SCADA Project (CBCIP #11190)	$118,912
Canal Flats	Canal Flats Water System Upgrade	$347,600
Capital Regional District	New Groundwater Supply - Cedars of Tuam Water, Salt Spring Island	$66,667
Capital Regional District	Water Treatment and Distribution Upgrade - Cedar Lane Water, Salt Spring Island	$316,667
Capital Regional District	Water Treatment Plant Upgrade - Highland Water, Salt Spring Island	$959,333
Columbia Shuswap Regional District	Cedar Heights Water Treatment System	$595,350
East Kootenay Regional District	Dry Gulch Water System	$1,798,000
Fraser Valley Regional District	Hatzic Island, Sheltered Cove and Vicinity Integrated Water System	$796,223
Fraser Valley Regional District	North Bend Water System Comprehensive Upgrades	$316,400
Gibsons	Water Cross Connection Control and Metering Program	$460,000
Grand Forks	Water System Reservoir Upgrading (CBCIP #9487)	$180,667
Hazelton	Water Supply, Treatment, Storage and Distribution	$533,333
Hope	Town Water Reservoir	$1,066,667
McBride	Water Intake Upgrades	$240,000
Montrose	Water Source Transmission Pipe Replacement	$357,333
Mount Waddington Regional District	Woss Water Improvements	$37,333
Nelson	Fairview Reservoir	$1,929,333
Okanagan-Similkameen Regional District	Naramata Water Supply Improvements - Phase 2	$2,333,333
Peachland	Water Quality Enhancement and Assurance	$389,800
Port Alberni	China Creek Watermain Replacement (Source Main) - Phase 1	$1,166,667
Port Moody	Chlorine Booster Stations - Phase 1 (Ioco Road)	$193,333
Powell River Regional District	Myrtle Pond Water System Upgrade	$703,457
Queen Charlotte	Proposed Water Supply - Queen Charlotte	$2,146,667
Squamish-Lillooet Regional District	Gold Bridge Water System Upgrade	$723,333
Sunshine Coast Regional District	Garden Bay Waterworks District UV Water Treatment System	$33,333
Thompson-Nicola Regional District	Walhachin Community Water System	$73,333
Thompson-Nicola Regional District	Black Pines Community Water System	$138,333
Thompson-Nicola Regional District	Evergreen Community Water System Upgrade (CBCIP 3809)	$21,667
Thompson-Nicola Regional District	Pritchard Community Water System (CBCIP #5779)	$176,504
Thompson-Nicola Regional District	Barriere Community Water System - Phase 1	$36,667
Thompson-Nicola Regional District	Spences Bridge Water System Upgrading	$777,333
		$19,240,245

Study grant commitments 2005/2006

Proponent	Grant Amount	Description
100 Mile House	$10,000	Water Treatment Plant Upgrading Study
Abbotsford	$10,000	Update of Water Master Plan
Armstrong	$10,000	Long-Term Water Treatment Plan - Phase 1
Armstrong	$5,000	Aquifer Protection Planning
Ashcroft	$10,000	Infrastructure Planning Needs Assessment
Belcarra	$10,000	Distribution Infrastructure - Belcarra West: Design and Costing
Belcarra	$10,000	Regional Water Source: Options and Costs
Belcarra	$10,000	Local Water Source: Options and Costs
Burnaby	$7,800	Water Loss Management Study
Burnaby	$10,000	Water Distribution System Model Update
Cache Creek	$7,500	Wellhead Protection Plan
Campbell River	$10,000	Residential Water Meter Pilot Project
Canal Flats	$10,000	Canal Flats Infrastructure Study
Canal Flats	$5,000	Eagles Nest Water System Study
Capital Regional District	$10,000	Water Conservation Workshop
Castlegar	$10,000	Water System Upgrading Plan
Central Kootenay Regional District	$5,150	Engineering Study of Brandon Waterworks District Water System
Central Kootenay Regional District	$10,000	Balfour Irrigation District Engineering Study
Central Kootenay Regional District	$5,000	Kitchener Improvement District Water System Study
Central Okanagan Regional District	$5,000	Trepanier Creek Water Supply Dam and Intake Study
Chase	$10,000	Water System Study
Chetwynd	$10,000	Water Distribution System Model and Analysis
Columbia Shuswap Regional District	$10,000	Trout Lake Improvement District Water Supply Alternatives
Columbia Shuswap Regional District	$10,000	Falkland Waterworks - Source and Capacity Assessment/DCC Revision
Cumberland	$10,000	Master Water Plan
East Kootenay Regional District	$6,200	Edgewater Improvement District Engineering Study Update
East Kootenay Regional District	$8,000	Waste and Water System SCADA Upgrade
East Kootenay Regional District	$8,600	Water Meter Implementation for Windermere, Timber Ridge and Edgewater
East Kootenay Regional District	$9,500	Windermere Water System Chlorine Contact Time Study
East Kootenay Regional District	$8,400	Elko Water System Pressure Issue
Elkford	$10,000	Infrastructure Assessment
Enderby	$7,500	Water Treatment Study
Fernie	$6,050	Investigations and Recommendations for Intake Structure for Fairy Creek Spring Source Phase 1

Study grant commitments 2005/2006 (continued)

Proponent	Grant Amount	Description
Fernie	$5,540	Investigations and Recommendations for Intake Structure for Fairy Creek Spring Source Phase 2
Fernie	$5,550	Pressure and Flow Monitoring of Water Distribution Network to Determine Possible Leaks and Losses Phase 1
Fernie	$8,250	Investigation of Force Main Alternatives Pumping From James White Park Well To Northwest Reservoir
Fraser Valley Regional District	$10,000	Environmental Impact Assessment and System Pre-Design for Hatzic Island Water System
Fraser Valley Regional District	$8,650	Feasibility Study on Acquisition of One and One Quarter Mile Creek Waterworks District System
Fraser Valley Regional District	$9,750	Water Conservation Plan and Public Evaluation Strategy for All Electoral Area Water Systems
Fraser Valley Regional District	$10,000	Cultus Lake Aquifer Identification and Protection Plan
Gibsons	$4,500	Well Head Protection Plan
Gold River	$10,000	Water Treatment Options Study
Golden	$10,000	Water Conservation Strategy Development
Granisle	$10,000	Leak Detection Study
Greater Vancouver Regional District	$10,000	Revision of Water Demand by Sector Process Engine
Harrison Hot Springs	$10,000	Water System Fire Protection Upgrading Study
Highlands	$5,000	Comprehensive Groundwater Monitoring Plan - Phase 1
Hope	$8,500	Silver Creek Well Protection Plan
Invermere	$5,100	Water Conservation and Demand Management Strategy Phase 1
Invermere	$8,500	Pressure and Flow Monitoring of Water Distribution Network to Determine Leaks and Losses Phase 1
Invermere	$10,000	Water Supply and Water Treatment Strategy 2005-2025
Invermere	$10,000	Domestic Water Supply - Evaluating the Least-Cost Long-Term Supply and Treatment Solution
Kamloops	$10,000	Rayleigh Waterworks District Water Treatment Study
Kimberley	$10,000	SCADA Needs Assessment Study
Kootenay Boundary Regional District	$10,000	Sutherland Creek Waterworks District - Groundwater Alternate Supply
Lake Country	$10,000	Lake Pine Water System Assessment Upgrade Plan
Lake Cowichan	$10,000	Alternate Water Supply Study
Logan Lake	$10,000	Wellhead Protection Program
Lumby	$10,000	Wellhead Protection Plan
Lumby	$10,000	Water System Study
Mission	$10,000	Development Cost Charge Review
Nanaimo Regional District	$10,000	Nanoose Water Local Service Area - Capital Asset Management Project

Study grant commitments 2005/2006 (continued)

Proponent	Grant Amount	Description
Nanaimo Regional District	$10,000	Deep Bay Waterworks District - Review of Pumping Capacities During Drought Conditions
Nelson	$10,000	Water Master Plan - Phase 1
Nelson	$10,000	Five Mile Pipeline Condition Assessment
North Okanagan Regional District	$10,000	Grandview Bench Water Supply Strategic Plan
North Okanagan Regional District	$10,000	Keddleston Water Supply Strategic Plan
North Vancouver District	$10,000	Water Sprinkling Demand Side Management
Northern Rockies Regional District	$10,000	Water Treatment Plant and Pump Stations Condition Assessment
Northern Rockies Regional District	$10,000	Water Use Efficiency Study
Okanagan-Similkameen Regional District	$7,500	Hedley Improvement District Infrastructure Study
Okanagan-Similkameen Regional District	$5,600	Tulameen Area Water System Study
Okanagan-Similkameen Regional District	$10,000	Gallagher Lake Area Feasibility Review
Okanagan-Similkameen Regional District	$5,000	Olalla Groundwater Protection Planning Phase 2
Peachland	$10,000	Water Master Plan Water Supply Study
Peachland	$10,000	Water Supply Study
Pemberton	$10,000	Water Utility Measurement and Conservaton Program - Phase 2
Port Alice	$5,000	Facilities Best-Use Study
Port Edward	$7,500	Water Main Replacement Identification
Powell River	$10,000	Drinking Water Protection Act Implementation
Powell River	$10,000	Water Use Efficiency Study
Powell River Regional District	$10,000	Southern Region Water Supply Study
Powell River Regional District	$10,000	Lund Waterworks District Technical Evaluation
Powell River Regional District	$10,000	Centennial Drive Water Study
Quesnel	$10,000	Capital Reinvestment Program - Phase 3
Saanich	$10,000	Water Pump Stations Condition Assessment
Spallumcheen	$7,200	Larkin and Eagle Rock Waterworks District Water Supply Study
Squamish-Lillooet Regional District	$10,000	Development of Source Control Bylaw
Sunshine Coast Regional District	$10,000	Water Rate Study and Design
Sunshine Coast Regional District	$7,500	Jervis Inlet Road Watermain Extension Study
Surrey	$10,000	Clayton and Cloverdale Zone Metering Program
Taylor	$6,500	Ultraviolet Disinfection Feasibility Study
Terrace	$10,000	Airport Lands Water Study
Thompson-Nicola Regional District	$7,500	Pritchard Community Water System Water Supply Review
Thompson-Nicola Regional District	$5,000	Black Pines Community Water System Water Supply Review

Study grant commitments 2005/2006 (continued)

Proponent	Grant Amount	Description
Thompson-Nicola Regional District	$5,000	Savona Improvement District Water Utility Feasibility Review
Thompson-Nicola Regional District	$5,000	Evergreen Community Water System Water Supply Review
Thompson-Nicola Regional District	$5,000	Miller Subdivision Water System Study
Trail	$10,000	Water Consumption Meters and Cross-Connection Control Program Study
Trail	$10,000	Water Treatment Plant Expansion Feasibility Study
Valemount	$9,800	Swift Creek Watershed - Issues Identification Study
Williams Lake	$10,000	Water Utility Business Plan
Total	**$893,140**	

Study grant commitments 2006/2007

Proponent	Grant Amount	Description
100 Mile House	$10,000	Water System Capacity Study
100 Mile House	$10,000	Community Water Source Study
Abbotsford	$10,000	2006 Water System Master Plan
Alberni-Clayoquot	$7,500	Bamfield Capital Asset Management Plan
Alberni-Clayoquot	$10,000	Beaver Creek Improvement District Source Options Study - Groundwater Source
Alberni-Clayoquot	$10,000	Beaver Creek Improvement District Source Options Study - Surface Source
Armstrong	$10,000	Long-Term Water Treatment Plan, Phase 2
Belcarra	$10,000	Potable Water Supply - Preferred Option PreDesign Study
Belcarra	$10,000	Water Use Efficiency Study
Burnaby	$10,000	Pump Station and PRV Condition Study
Campbell River	$10,000	Water System Strategy Phase One
Campbell River	$10,000	Utility Rate Revision
Capital	$10,000	North Salt Spring Waterworks District - Conversion Study Phase 2
Capital	$6,500	Erskine Heights Water Utility Conversion Study
Capital	$10,000	Piers Island Improvement District Conversion Study
Capital Regional District	$10,000	Village Point Improvement District - Conversion Study (Water)
Capital Regional District	$10,000	North Salt Spring Waterworks District - Conversion Study Phase 1
Central Coast	$5,000	Bella Coola Water Conservation Plan
Central Kootenay Regional District	$5,000	Orde Creek Improvement District Water System Engineering Study
Central Kootenay Regional District	$7,500	South Kootenay Lake Basin and Creston Valley Water Management Plan
Chase	$10,000	Groundwater Investigation Study
Chase	$10,000	Water Treatment Feasibility Study
Comox	$10,000	Hutton Road and Simon Crescent Water Extension

Study grant commitments 2006/2007 (continued)

Proponent	Grant Amount	Description
Cowichan Valley	$10,000	Shawnigan Lake North Water System Metering Program and Water Conservation Program
Cowichan Valley	$10,000	Saltair Water Distribution System - Study and Evalution of Existing System
Cowichan Valley	$10,000	Satellite Park Water System Reservoir Study
Creston	$10,000	Water Conservation Plan
Dawson Creek	$10,000	Water Cost Study
East Kootenay Regional District	$7,500	Columbia Basin Trust Water Conservation Symposium
Fort St. John	$10,000	Charlie Lake Water Treatment Plant Retrofit Study
Fraser Lake	$10,000	Pilot Study for Water Treatment System
Gibsons	$10,000	Water Audit and Leak Detection
Invermere	$10,000	Evaluate Water Distribution Network to Determine Leaks and Losses
Invermere	$10,000	Water Conservation and Demand Management Strategy Phase 2
Kamloops	$10,000	Watershed Management Plan
Kamloops	$10,000	Southwest Sector Water Supply Upgrades
Kaslo	$7,100	Kemp Creek Reservoir Study
Keremeos	$8,950	Groundwater Protection Planning
Kimberley	$10,000	Feasibility Study on Ultraviolet Disinfection
Langley	$10,000	Water Demand Management Strategy
Mackenzie	$10,000	Water System Improvements
Maple Ridge	$10,000	Watermain Condition Assessment Study
Merritt	$10,000	Well Rehabilitation Assessment and Groundwater Evaluation
Merritt	$10,000	Source Water Characterization and Treatability Assessment
Montrose	$10,000	Strategic Capital Waterworks Upgrade Plan
Mount Waddington	$10,000	Coal Harbour Capital Asset Management Plan
Nakusp	$10,000	Water Master Plan
Nanaimo Regional District	$10,000	Capital Asset Management Project
New Westminster	$10,000	Asset Management Plan Development Phase 3
Okanagan-Similkameen	$5,000	East Princeton Waterworks District Water Feasibility Study
Okanagan-Similkameen	$7,500	West Bench Water Quality Improvement Feasibility Review
Oliver	$9,750	Water Conservation Study
Peachland	$10,000	Water Master Plan Phase 2 Study
Pemberton	$10,000	Water System Capacity Study
Pemberton	$10,000	New Groundwater Well - Location and Treatment Options
Powell River Regional District	$10,000	Stillwater Waterworks District Water Study
Powell River Regional District	$10,000	Lund Waterworks District Water Well Testing

Study grant commitments 2006/2007 (continued)

Proponent	Grant Amount	Description
Powell River Regional District	$10,000	Van Anda Improvement District Water Study
Princeton	$9,975	Groundwater Management Planning Phase 2
Quesnel	$10,000	Preliminary Water Chlorination Assessment - Secondary Disinfection
Revelstoke	$10,000	Big Eddy Waterworks District Sewage Study
Silverton	$10,000	Five-Year Strategic Capital Waterworks Program
Skeena-Queen Charlotte Regional District	$6,500	Dodge Cove Improvement District Water Upgrade
Skeena-Queen Charlotte Regional District	$10,000	Oona River Water and Septage System Investigation
Spallumcheen	$10,000	Test/Monitoring Well
Sparwood	$10,000	Community Groundwater Management Plan
Trail	$10,000	Water Study - Future Needs
Vernon	$10,000	Complete Infrastructure Long-Term Financial Plan
Victoria	$10,000	Steel Watermain Rehabilitation Study
Victoria	$10,000	Capital Asset Management Plan Pilot Project
View Royal	$10,000	Asset Management/Infrastructure Management Database
Warfield	$10,000	Potable Water Supply
West Vancouver	$10,000	Eagle Lake Simulation Model
West Vancouver	$10,000	Montizambert Creek Water Treatment Alternatives Study
BCWWA	$7,500	Managing Small Water Systems: Phase 1
BCWWA	$7,500	Managing Small Water Systems: Phase 2
Total	**$718,775**	